KALAMAZOO|BATTLE CREEK
INTERNATIONAL AIRPORT

Master Plan

Final Report

The preparation of this document was financed in part through a planning grant from the Federal Aviation Administration (FAA) as provided under Section 505 of the Airport and Airway Improvement Act, as amended. The contents do not necessarily reflect the official views of the FAA. Acceptance of this report by the FAA does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein not does it indicate the proposed development is environmentally acceptable in accordance with appropriate public laws.

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Chapter 1

Inventory of Existing Facilities

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Inventory of Existing Facilities

In an effort to establish a solid plan for future development, the Kalamazoo/Battle Creek International Airport (the Airport), along with the Federal Aviation Administration (FAA), and the Michigan Department of Transportation – Office of Aeronautics (MDOT Aero) have elected to update the Airport's Master Plan which was published in June 1999. The first step in determining development which may be necessary in the future is to conduct an inventory of existing facilities at the Airport. This Chapter reviews the existing facilities and provides a background on airport design standards which are set forth in FAA Advisory Circular (AC) 150/5300-13, *Airport Design*. An understanding of these design elements along with a review of existing conditions is necessary to plan effectively to meet future needs.

The inventory conducted in this Chapter was accomplished through various means including physical inspection of the facilities, interviews with users, tenants and Airport management, telephone conversations, and review of appropriate federal, state and Airport records. A large volume of data was reviewed, collected and analyzed as part of the inventory effort. Detailed information from this Chapter is utilized in subsequent chapters to support various analyses required in the master planning process. This Chapter seeks to provide an overall summary of existing facilities at the Airport and is organized into the following sections:

- 1.1 General Airport Description and Location
- 1.2 Airport History
- 1.3 Airport Environment
- 1.4 Land Use
- 1.5 Socioeconomic Data
- 1.6 Airport Management
- 1.7 Existing Facilities
- 1.8 Airport Tenants
- 1.9 Airspace and Air Traffic Control
- 1.10 Summary

1.1 General Airport Description and Location

The Kalamazoo/Battle Creek International Airport is classified as a non-hub, commercial service airport and serves the Kalamazoo and Battle Creek areas, among other communities in southwest Michigan. The Airport's inclusion in the FAA's National Plan of Integrated Airport

Systems (NPIAS) is indicative of its significance in the national air transportation system. At the state level, the State of Michigan classifies the Airport as a Tier-I, commercial service airport. Tier-I airports respond to essential and critical state airport system goals and objectives and should be developed to their full and appropriate extent.

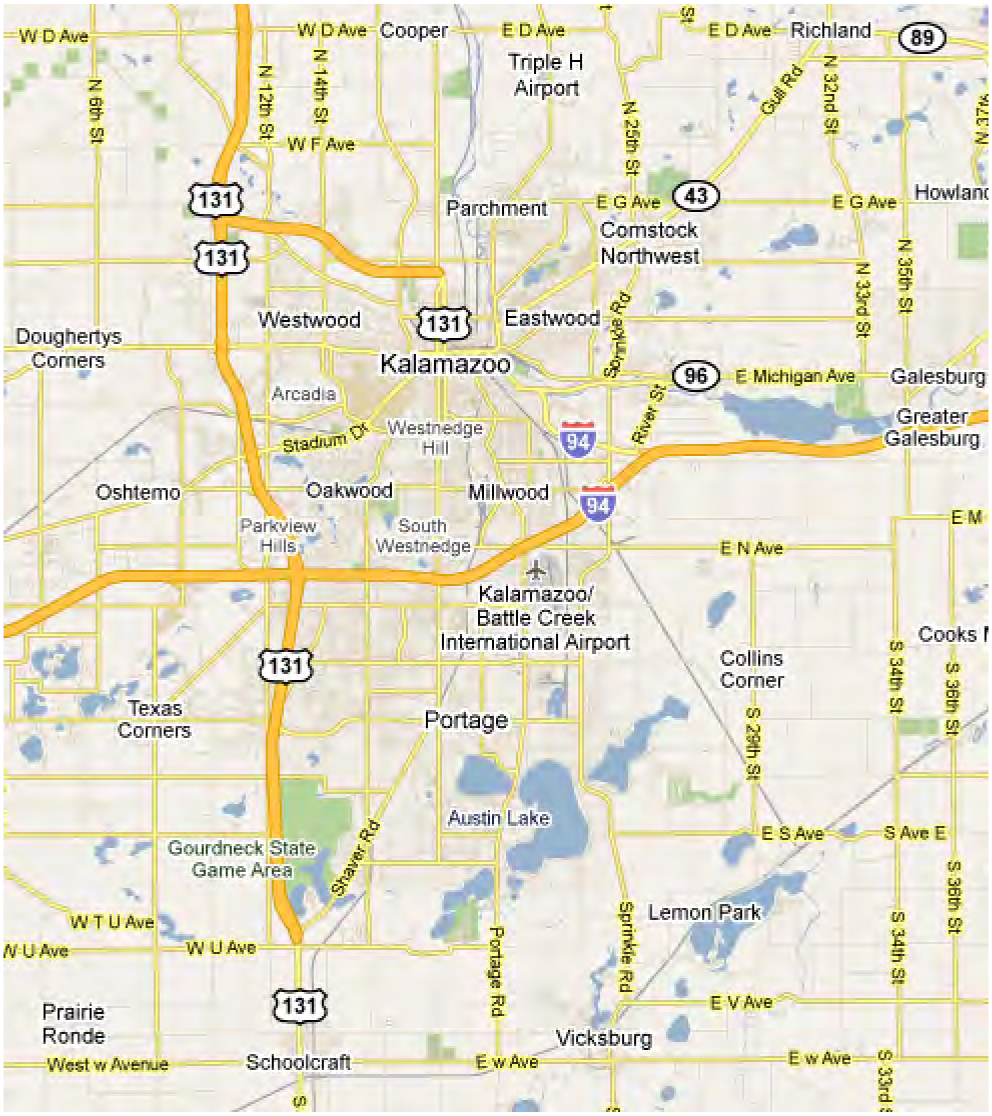
The Airport is located within the city limits of Kalamazoo in Kalamazoo County, Michigan. **Figure 1-1** depicts the Airport's location regionally while **Figure 1-2** illustrates the Airport's location locally. Although located within the city limits of Kalamazoo, it should be noted that the city limit between Kalamazoo and Portage runs adjacent to the Airport on its southern border. See **Figure 1-3** for a property map of the Airport. Kalamazoo is located approximately 50 miles south of Grand Rapids, 130 miles west of Detroit and 100 miles northeast of Chicago.

Figure 1-1
Regional Airport Location Map

Source: MapQuest.com

Kalamazoo's location between other major metropolitan centers in the Midwest has allowed it to enjoy growth and economic prosperity throughout its history. The City has become a sort of crossroads between these population centers, since Interstate 94 (which connects Detroit to the east and Chicago/Northern Indiana to the west) passes through Kalamazoo. US-131 also passes through the area, providing access to Grand Rapids to the north and Indiana to the south. Additionally, a major east-west Amtrak rail line passes through the City providing daily rail passenger service.

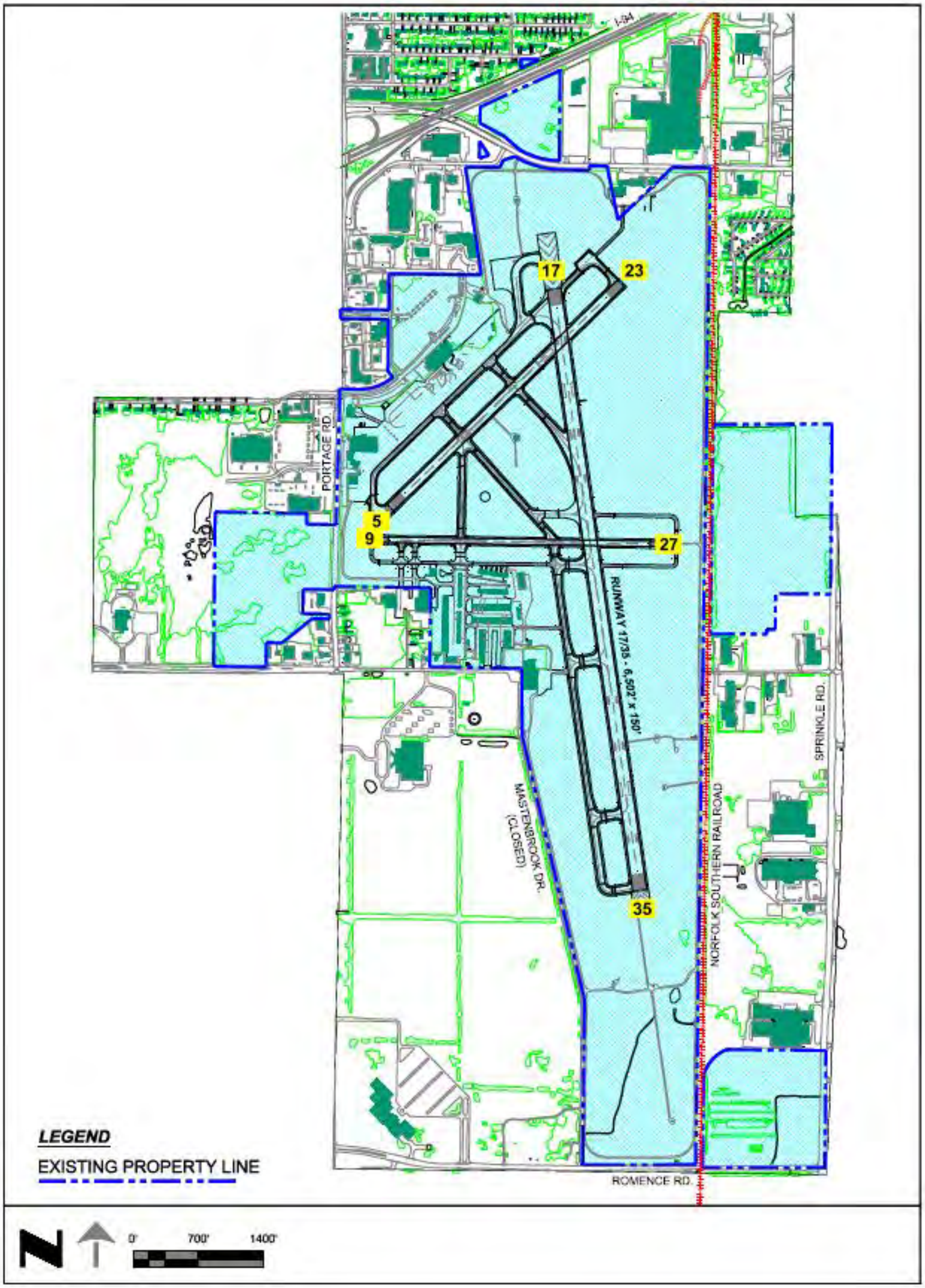
Figure 1-2
Local Airport Location Map



Source: Google.com

Kalamazoo is home to many prominent businesses including pharmaceutical giant Pfizer, medical technology firm Stryker Corporation and industrial manufacturer Eaton Corporation. Other businesses in the Kalamazoo area include PNC Bank, Bronson Healthcare Group and Borgess Health. Perrigo Company, based in Allegan, also contributes to the Kalamazoo economy. The City is also home to two well-known higher education institutions, Western Michigan University (a nationally recognized research institution with approximately 24,500 students) and Kalamazoo College (a private liberal arts school).

Figure 1-3
Property Map



Source: Mead & Hunt

Along with Kalamazoo, the Airport also serves the Battle Creek area which is located approximately 20 miles east. Battle Creek is a similar sized city with several prominent businesses that utilize the Airport. Known as the “Cereal City” for its cereal production, the Kellogg Company and Post Foods (both leaders in the breakfast food industry) call Battle Creek home. Other businesses in Battle Creek include Denso Manufacturing, Battle Creek Health Systems and the Defense Logistics Agency which provides logistic support for the United States military.

1.2 Airport History

Plans to build an airport to serve the Kalamazoo area began in 1925 and concluded in 1926 when the City of Kalamazoo purchased 383 acres of land near Portage Road and Kilgore Road. In July 1928, regular airmail service started at the Airport leading the facility to become the first licensed municipal airport in Michigan in February 1929. At this time, the Airport was named Lindbergh Field in honor of famous aviator Charles Lindbergh.

The first airline service was initiated at the Airport in May 1944 and followed with service by many small airlines until 1955 when North Central Airlines began daily service from Kalamazoo to Detroit, Michigan and Chicago, Illinois. In 1958, a new terminal was constructed to replace the original building that had served the Airport since the 1920’s. In 1961, an air traffic control tower was constructed and Runway 17/35 was lengthened to 5,300 feet. Other airfield improvements included the installation of an instrument landing system (ILS) in 1963 and another extension of Runway 17/35 to 6,500 feet in 1977. Due to a constant growth of passengers, an expansion of the terminal building was conducted in 1979 to increase the size of the building from 12,000 to 30,000 square feet.

In 1982, the City of Kalamazoo, who had owned and operated the Airport since its inception, transferred ownership to the County of Kalamazoo in 1984. Increased passenger levels at the Airport called for another expansion of the terminal that was completed by the County in 1989. This renovation included a new concourse, enlarged boarding area, new baggage claim and a terminal ramp expansion. Also in 1989, in an effort to bring attention to the Airport’s ability to service the Battle Creek market, the Airport changed its name from the Kalamazoo County Airport to its current name – Kalamazoo/Battle Creek International Airport. The last major expansion project at the Airport was completed in 1994 with an expansion of the parking lot to accommodate passenger levels which had grown to over 500,000 per year.

Currently, the Airport is served by three airlines including American Eagle (offering flights to Chicago-O’Hare), Delta (offering flights to Detroit and Minneapolis), and Direct Air (offering flights to Punta Gorda, Florida and Orlando-Sanford, Florida). The Airport recently constructed a new terminal building and is presently involved with the construction of a new FAA Air Traffic Control Tower (ATCT) and Terminal Radar Approach Control (TRACON) facility that will serve the air traffic needs of the Airport and surrounding region for years to come.

1.3 Airport Environment

In order to plan for future development, it is important to note the conditions of the Airport's environment. Conditions such as soil, topography, wind and weather conditions can affect how development occurs. This section seeks to explain the current airport environs in an effort to understand conditions that may affect future development at the Airport.

1.3.a Topography – The elevation of the Airport is 874 feet Mean Sea Level (MSL) and gradually slopes downward from this elevation from southwest to northeast to an elevation of 851 feet MSL. Overall, the topography of the land is relatively flat, and should not be a factor in planning for development opportunities. It should be noted that a small wetland area exists towards the northeast corner of the Airport, just to the southeast of the approach end of Runway 23. This wetland could affect any future development in the northeast corner of the Airport. A more detailed look at this wetland is provided later in Chapter 5 – Environmental Overview.

1.3.b Soil – A majority of Airport property is designated Urban Land – Kalamazoo complex with a zero to six percent (0%-6%) slope by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey website (http://websoilsurvey.nrcs.usda.gov). Another prominent soil found on existing airport property, Adrian muck, can be found southeast of the approach end of Runway 35 and east of Runways 5/23 and 9/27. According to the USDA NRCS soil survey website, land southwest of the approach end of Runway 35, between the Kalamazoo Aviation History Museum (Air Zoo) and Romence Road is comprised of two to six percent (2%-6%) and six to twelve percent (6%-12%) slopes of Kalamazoo loam. These soils are traditionally suitable for aviation related development. Any future development at the Airport will include a site-specific geotechnical soil analysis when designed.

1.3.c Meteorological/Climate Conditions – An important element of the environmental conditions at an airport is the local climate. Since weather can affect airport and aircraft operations, it is important to understand local weather conditions which ultimately will impact future development. The climate of Kalamazoo is typical of other Midwestern states with cold, snowy winters and mild, sometimes humid summers. Kalamazoo is also greatly influenced by Lake Michigan located approximately 40 miles to the west. Since the City is relatively close to Lake Michigan, its climate is affected by the lake-effect phenomena which occurs when cool winds blow over warmer waters causing water vapor to rise which then freezes and is deposited as precipitation on windward shores. The lake-effect is most noticeable during the winter months when cold winter air blows over warmer lake water creating heavy snow fall in regions close to Lake Michigan.

As a result of lake-effect snowfall, the Airport on average receives approximately 70 inches of snowfall per year. In January, the month with the coldest average temperature, Kalamazoo averages a high of 32 degrees Fahrenheit (32°F) and a low of 17 degrees Fahrenheit (17°F). During the summer months, the Kalamazoo area receives on average 36 inches of rain. In July, the month with the warmest average temperature, Kalamazoo averages a high of 84 degrees

Fahrenheit (84°F) and a low of 62 degrees Fahrenheit (62°F). On average, Kalamazoo experiences approximately 130 days of precipitation and 161 days of sunshine annually.

1.3.d Wind – Another important environmental element at any airport is prevailing wind. Since aircraft land and take off into the wind, it is important to analyze the ability of an airport's runway orientation to meet local wind coverage percentages. Ideally, the orientation of runways should be aligned to meet prevailing winds in the area. Desirable wind coverage is 95 percent (95%) as defined by the FAA. An airport's ability to meet this desired wind coverage is important for aircraft operation, especially for smaller aircraft since they are greatly impacted by crosswinds, which are winds perpendicular to an aircraft's path of travel.

Based on an analysis of wind data provided by the National Climatic Data Center and utilizing FAA airport design software, it was determined that the alignment of the Airport's runways provide 99.7 percent (99.7%) wind coverage during all weather conditions in a 10.5 knot crosswind. A 10.5 knot crosswind was utilized in this evaluation because smaller aircraft are more susceptible to crosswind conditions and may not be able to operate if crosswind conditions are excessive. **Table 1-1**, **Table 1-2** and **Table 1-3** illustrate wind coverage at the Airport during Visual Flight Rules (VFR), Instrument Flight Rules (IFR) and all weather conditions, respectively. Based on the data provided for all weather conditions, the orientation of the runways at the Airport provides sufficient local wind coverage.

Table 1-1
VFR Condition Wind Coverage (in percent)

<table>
<tr><th>Crosswind Component</th><th>Aircraft Type Most Affected</th><th>Rwy 17</th><th>Rwy 35</th><th>Rwy 5</th><th>Rwy 23</th><th>Rwy 9</th><th>Rwy 27</th></tr>
<tr><td rowspan="4">10.5 knots</td><td rowspan="4">Small GA</td><td>68.4</td><td>58.0</td><td>53.0</td><td>76.9</td><td>56.8</td><td>77.5</td></tr>
<tr><td colspan="2">91.4</td><td colspan="2">91.4</td><td colspan="2">90.6</td></tr>
<tr><td colspan="4">96.9</td><td></td><td></td></tr>
<tr><td colspan="6">99.7</td></tr>
<tr><td rowspan="3">13 knots</td><td rowspan="3">Corporate GA</td><td>70.8</td><td>60.6</td><td>54.6</td><td>80.4</td><td></td><td></td></tr>
<tr><td colspan="2">95.6</td><td colspan="2">95.6</td><td></td><td></td></tr>
<tr><td colspan="4">99.1</td><td></td><td></td></tr>
<tr><td rowspan="2">16 knots</td><td rowspan="2">Commercial</td><td>72.8</td><td>62.9</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">98.9</td><td></td><td></td><td></td><td></td></tr>
</table>

Note: Tailwind Component 3 knots on single runway end coverages
Source: National Climatic Data Center, FAA Standard Wind Analysis tool
Station: Kalamazoo, MI
Period of Record: 2000-2009; 70,905 VFR Weather Observations
VFR = Ceiling greater than or equal to 1000 feet and visibility greater than or equal to 3 statute miles.

Table 1-2
IFR Condition Wind Coverage (in percent)

<table>
<tr><th>Crosswind Component</th><th>Aircraft Type Most Affected</th><th>Rwy 17</th><th>Rwy 35</th><th>Rwy 5</th><th>Rwy 23</th><th>Rwy 9</th><th>Rwy 27</th></tr>
<tr><td rowspan="3">10.5 knots</td><td rowspan="3">Small GA</td><td>65.7</td><td>58.3</td><td>54.5</td><td>70.4</td><td>57.9</td><td>71.6</td></tr>
<tr><td colspan="2">89.3</td><td colspan="2">90.4</td><td colspan="2">91.5</td></tr>
<tr><td colspan="4">96.1</td><td></td><td></td></tr>
<tr><td rowspan="3">13 knots</td><td rowspan="3">Corporate GA</td><td>68.6</td><td>61.6</td><td>56.1</td><td>73.9</td><td></td><td></td></tr>
<tr><td colspan="2">94.3</td><td colspan="2">95.1</td><td></td><td></td></tr>
<tr><td colspan="4">98.8</td><td></td><td></td></tr>
<tr><td rowspan="2">16 knots</td><td rowspan="2">Commercial</td><td>71.1</td><td>64.6</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">98.5</td><td></td><td></td><td></td><td></td></tr>
</table>

Note: Tailwind Component 3 knots on single runway end coverages
Source: National Climatic Data Center, FAA Standard Wind Analysis tool
Station: Kalamazoo, MI
Period of Record: 2000-2009; 9,345 IFR Weather Observations
IFR = Ceiling less than 1000 feet but greater than or equal to 200 feet and/or visibility less than 3 statue miles but greater than or equal to 1/2 statute mile.

Table 1-3
All Weather Conditions Wind Coverage (in percent)

<table>
<tr><th>Crosswind Component</th><th>Aircraft Type Most Affected</th><th>Rwy 17</th><th>Rwy 35</th><th>Rwy 5</th><th>Rwy 23</th><th>Rwy 9</th><th>Rwy 27</th></tr>
<tr><td rowspan="4">10.5 knots</td><td rowspan="4">Small GA</td><td>68.2</td><td>58.1</td><td>53.3</td><td>76.2</td><td>57.2</td><td>76.8</td></tr>
<tr><td colspan="2">91.2</td><td colspan="2">91.3</td><td colspan="2">90.7</td></tr>
<tr><td colspan="4">96.8</td><td></td><td></td></tr>
<tr><td colspan="6">99.7</td></tr>
<tr><td rowspan="3">13 knots</td><td rowspan="3">Corporate GA</td><td>68.2</td><td>58.1</td><td>53.3</td><td>76.2</td><td></td><td></td></tr>
<tr><td colspan="2">95.5</td><td colspan="2">95.6</td><td></td><td></td></tr>
<tr><td colspan="4">99.0</td><td></td><td></td></tr>
<tr><td rowspan="2">16 knots</td><td rowspan="2">Commercial</td><td>68.2</td><td>58.1</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">98.8</td><td></td><td></td><td></td><td></td></tr>
</table>

Note: Tailwind Component 3 knots on single runway end coverages
Source: National Climatic Data Center, FAA Standard Wind Analysis tool
Station: Kalamazoo, MI
Period of Record: 2000-2009; 81,040 All Weather Observations

1.4 Land Use

An analysis of current land use surrounding the Airport is important since the Airport for the most part is landlocked with limited room for development. The northern boundary of the Airport is surrounded with dense residential and commercial development and is bordered by Portage Road and Kilgore Road, with Interstate 94 intersecting these roads northwest of the Airport. To the east, the Airport is bordered by a Norfolk Southern railroad line that leads to a Pfizer manufacturing facility that, along with Romence Road, borders the Airport to the south. Undeveloped land owned by Pfizer is located southwest of the existing Airport property. To the north of this undeveloped land is the Kalamazoo Aviation History Museum which is commonly known as the Air Zoo. North of the Air Zoo and east of the Airport are residential neighborhoods with some commercial development.

Since there is limited room for growth and expansion, it is important that the Airport be proactive in keeping surrounding land uses from becoming more incompatible. Incompatible land uses are those which impede aircraft operations at an airport and threaten the safety and quality of life for people living and working in proximity to an airport. Examples of incompatible land uses include tall structures, land uses with high concentrations of people, and land uses that attract wildlife. Although examples of these land uses can be found in proximity to the Airport, it is important that a proactive approach be used to mitigate any future land uses that could be detrimental to airport operations and quality of life.

1.5 Socioeconomic Data

Gaining an understanding of existing socioeconomic conditions in the Airport's service area helps establish a baseline to predict future growth and use of the facility. Although the service area of the Airport extends across state lines and into many counties, data from Kalamazoo, Calhoun and Van Buren counties was used for the purpose of reviewing socioeconomic conditions.

According to information provided by Woods & Poole Economics, Inc., the estimated population of the three counties in 2009 was 461,671, a 1.82 percent (1.82%) increase from the 2000 population estimate of 453,399. The total mean household income of the three counties in 2009 was estimated at $77,729. **Table 1-4** displays the socioeconomic data by county.

Table 1-4
County Socioeconomic Data

County	Population		% Change	Mean Household Income	
	2009	2000		2009	2000
Kalamazoo	247,151	239,036	3.39%	$85,187	$68,201
Calhoun	135,996	138,012	-1.46%	$74,650	$62,549
Van Buren	78,524	76,351	2.84%	$73,349	$58,809
Total	461,671	453,399	1.82%	-	-
Average	-	-	-	$77,729	$63,186

Source: Woods & Poole Economics, Inc.

Also important in understanding the socioeconomic data of the region is the population and total mean household income for the largest cities in the service area of the Airport. For this review, information for the cities of Kalamazoo, Portage and Battle Creek was used. Based on the most current estimates provided by the United States Census Bureau, the three cities had a combined 2008 population total of 170,365, which is a 2.87 percent (2.87%) decrease from the 2000 population estimate of 175,406. Estimates provided by the American Community Survey (ACS) calculated the median household income of the three cities from January 2006 to December 2008 at $51,076. See **Table 1-5** for data of the individual cities.

Table 1-5
City Socioeconomic Data

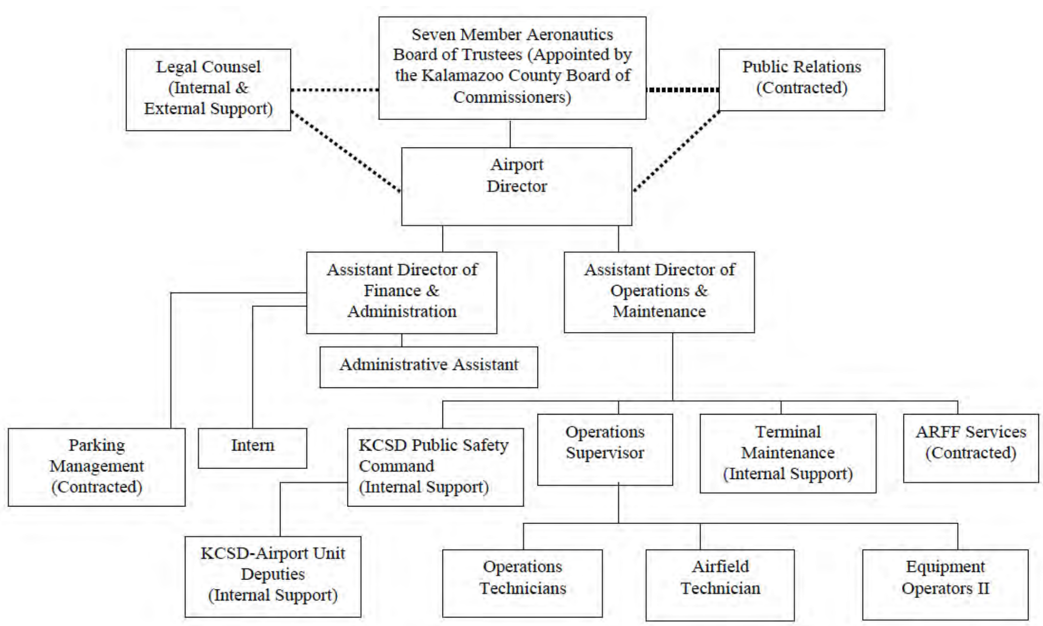
City	Population		% Change	Median Household Income	
	2008	2009		2006-2008 ACS Estimate	2000
Kalamazoo	72,179	77,145	6.44%	$44,523	$31,189
Battle Creek	52,053	53,364	2.46%	$39,052	$35,491
Portage	46,133	44,897	-2.68%	$71,732	$49,410
Total	170,365	175,406	2.87%	-	-
Average	-	-	-	$51,769	$38,697

Source: U.S. Census Bureau estimates

1.6 Airport Management

The Airport is owned and operated by the County of Kalamazoo and is managed by the Airport Manager who oversees day to day operations. The Airport Director reports to the Kalamazoo Aeronautics Board which is charged by the County with policy and development decisions at the Airport. The Assistant Director of Operations and Maintenance, Operations Supervisor, Assistant Director of Finance, and Administration and Administrative Assistant positions all report to the Airport Director in their respective roles. Other departments that are responsible for the day to day operation of the Airport report to the Operations Supervisor and Assistant Director of Operations and Maintenance, and include Airfield Maintenance, Terminal Maintenance, Airport Operations, and Aircraft Rescue and Fire Fighting (ARFF). See **Figure 1-4** for an organizational chart of the Airport.

Figure 1-4
Airport Organizational Chart



Source: Kalamazoo/Battle Creek International Airport

1.7 Existing Facilities

To plan for future development at the Airport, it is important to review the facilities that currently exist. Reviewing existing facilities provides a greater understanding of the Airport's ability to meet current and future user needs. Evaluating how existing needs are met along with reviewing forecasts of future activity allows for adequate and effective planning to take place to meet anticipated need in the future. This section provides a brief review of facilities found at the Airport, including facilities found on the airfield (such as runways, taxiways, ramps, and navigational equipment), aviation related support facilities (such as the terminal building, maintenance and ARFF buildings, and aircraft hangars), and landside items (such as airport access and vehicle parking).

1.7.a Runways – The Airport has three runways; Runway 17/35, Runway 5/23, and Runway 9/27. Runway 17/35 is oriented in a north-south direction, is 6,502 feet long and 150 feet wide, and is the primary runway at the Airport. Runway 5/23 is 3,438 feet long and 100 feet wide, and is the primary crosswind runway. Runway 9/27 is 2,800 feet long and 60 feet wide, and serves as a secondary crosswind runway. In addition to length, width, and orientation, runway strength is also important to evaluate for each runway. **Table 1-6** presents the strengths of each runway at the Airport based upon landing gear configurations.

Table 1-6
Runway Weight Bearing Capacity

Land Gear Configuration	Runway 17/35	Runway 5/23	Runway 9/27
Single Wheel	85,000 lbs.	30,000 lbs.	30,000 lbs.
Double Wheel	121,000 lbs.	45,000 lbs.	60,000 lbs.
Double Tandem	240,000 lbs.	60,000 lbs.	Not rated

Source: FAA Form 5010

The strength of runway pavement surfaces is also evaluated using the Pavement Condition Index (PCI). The PCI is a standard used in the aviation industry to assess pavement conditions. It is calculated using a variety of factors such as structural integrity, structural capacity, roughness, skid resistance/hydroplaning potential and rate of deterioration. The PCI is based on a scale from 0 to 100 with pavement rated 100 considered to be in "excellent" condition while pavement rated less than 10 is considered "failed".

The Airports Division of the Michigan Department of Transportation, Office of Aeronautics inspected the Airport in July 2007 and assigned PCI ratings for all airfield surfaces. Runway 17/35 was found to be in "good" condition, with small quantities of pavement cracking, patching and weathering recorded. Runway 5/23 was also found to be in "good" condition with moderate quantities of pavement cracking observed. Runway 9/27 was found to be in "very good" condition with small isolated areas of cracking recorded. **Table 1-7** illustrates the PCI ratings from this inspection assigned for each runway.

Table 1-7
July 2007 Runway PCI Ratings

Runway	17/35	5/23	9/27
PCI Rating	67	88	89

Source: MDOT Aero

1.7.b Taxiways – Taxiways are designed to allow for the safe movement of aircraft between runways and destinations on the airfield, and are designed to keep aircraft off active runways to meet these destinations. Different types of taxiways serve different purposes on the airfield. Parallel taxiways are located parallel to runway and allow aircraft to taxi to each end, minimizing occupancy times on the runway. Connector taxiways are small, stub taxiways that connect the runway to the parallel taxiway. These are designed to allow aircraft to access the runway for takeoff and provide points for aircraft to exit the runway after landing. Other types of taxiways allow aircraft high speed turnoffs from a runway and provide access from one point on an airfield to another. **Table 1-8** lists the taxiways and their associated PCI rating.

1.7.c Aprons – Aprons, also known as ramps, are large paved surfaces designed for the parking of aircraft. Along with providing parking, aprons also are used for the loading and unloading of passengers and cargo, aircraft fueling, and aircraft maintenance. Aprons are usually found near terminal buildings, hangars, aircraft maintenance facilities, and fixed base operators (FBOs). Aprons at the Airport can be found in front of the commercial passenger airline terminal and in front of the fixed base operator. Other smaller, private aprons can be found in the T-hangar area and at the Air Zoo on the south end of the Airport. **Table 1-8** lists aprons found at the Airport at the associated PCI rating.

1.7.d Navigational Aids (NAVAIDs)– Navigational aids (NAVAIDs) are equipment installed on an airfield that assist pilots in locating an airport both visually and electronically, and assist a pilot in determining the correct glide path when on approach to land. Navigational aids are most important during times of inclement weather and during nighttime conditions when a pilot's visibility is hindered. With properly installed equipment, a pilot can utilize these NAVAIDs to land an aircraft at an airport with zero visibility. Reviewing the NAVAIDs at the Airport is important because this can increase the capacity, or the ability to handle a given volume of traffic during times of poor visibility. In this section, the navigational aids at the Airport are broken down into visual and electronic types.

Table 1-8
Taxiway and Apron PCI Ratings

Surface	PCI Rating
Taxiway A	79
Taxiway B	100
Taxiway B1	100
Taxiway B2	100
Taxiway B3	100
Taxiway C	54
Taxiway D	86
Taxiway E	72
Taxiway F	91
Taxiway G	78
Terminal Apron	52
FBO Apron	71
Northeast T-Hangar Aprons	74
Southeast T-Hangar Aprons	96
West T-Hangar Aprons	57
West Tenant Aprons	65

Source: Michigan Department of Transportation
Note: PCI ratings from July 2007 site inspection

- **Visual NAVAIDs –** Visual navigational aids are those used to identify the airfield during approach, landing, and taxiing both at night and in adverse weather conditions. These navigational aids include different types of equipment that provide visual cues to pilots.
    - **Rotating Beacon** – To identify the location of the Airport at night, a rotating beacon, located on top of the control tower, flashes a green and white light signaling the Airport is a public use facility. The beacon, equipped with a green lens and a white lens 180 degrees apart from each other, rotates 360 degrees to allow it to be seen by air. This navigational aid is useful for pilots when trying to locate the Airport visually from a distance.
    - **Wind Indicators** – Wind indicators, commonly known as a wind socks, are orange fabric cones that show the direction and strength of the wind. These visual aids are useful for pilots readying for takeoff or on short final approach to the runway to make any last minute navigational corrections to adjust for the prevailing wind. Three wind indicators can be found on the airfield; one in the middle of the segmented circle located towards the middle of the airfield between Taxiway A, Taxiway D and Runway 9/27; the second is located east of the intersection of Runway 17/35 and Runway 5/23; and the third wind indicator is located north of Taxiway B2 on the south end of the airfield.

- **Segmented Circle** – A segmented circle is located at the Airport between Taxiway A, Taxiway D and Runway 9/27. Segmented circles with traffic pattern indicators are typically used to define right or left hand traffic patterns at non-towered airports. Since the Airport has a tower and pilots are required to contact ATCT for the traffic pattern, traffic pattern indicators are not included with the segmented circle at the Airport. At the Kalamazoo/Battle Creek International Airport, the segmented circle helps to identify the primary wind indicator which is located in the middle of the circle.

- **Runway Edge Lights** – Although considered more of an airfield lighting element than a navigational aid, runway edge lights serve as an important navigational tool for pilots. By illuminating the outline of the runway, pilots are able to gain visual navigational information such as the location, length and width of a runway during nighttime and in inclement weather situations. Airports with instrument approaches have amber-colored edge lighting on the last 2,000 feet of a runway which notifies pilots of the remaining runway distance available.

  Runways with edge lights are equipped with High Intensity Runway Lights (HIRL), Medium Intensity Runway Lights (MIRL) or Low Intensity Runway Lights (LIRL). Runways with HIRL offer greater illumination intensity and variable intensity settings than runways equipped with MIRL or LIRL systems. LIRL systems typically offer one intensity setting. The primary runway at the Airport, Runway 17/35, is equipped with HIRL while Runway 5/23 and Runway 9/27 are equipped with MIRL.

- **MALSR** – A Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) is installed on runways to complement instrument landing system (ILS) equipment that helps pilots visually acquire and align aircraft with the centerline of a runway. Consisting typically of an arrangement of nine light bars with five lights each, and five additional light locations for sequenced flashing lights, MALSRs help a pilot locate the landing threshold of a runway in low visibility situations. At the Airport, Runway 35 is equipped with a MALSR.

- **Precision Approach Path Indicator (PAPI)** – A Precision Approach Path Indicator (PAPI) is an approach lighting system that provides pilots the correct glide slope when on approach to a runway. Typically installed as a row of four individual lighting units equipped with red and white lights directed at different angles, the correct orientation of white and red lights shows a pilot that he is on the correct glide slope; any other orientation tells the pilot he is above (too high) or below (too low) the correct approach slope. At the Airport, the approach ends of Runway 17, Runway 35, Runway 5 and Runway 23 are equipped with PAPIs.

- **Runway End Identifier Lights (REIL**) – Runway End Identifier Lights (REILs) are designed to help pilots locate the end of a runway in low visibility situations or when the surrounding terrain makes identification of the runway difficult. A REIL system consists of a pair of synchronized flashing lights, one located on either end of the runway threshold. At the Airport, REILs can be found on Runway 5, Runway 17 and Runway 23.

- **Electronic NAVAIDs –** To support aircraft operations during times of low visibility, low cloud ceiling heights, and during inclement weather, electronic navigational aids need to be installed at an airport to complement the visual aids. Electronic NAVAIDs allow properly equipped aircraft to utilize electronic signals emitted by these aids to allow aircraft to perform landings based only on the readings received from instruments in the cockpit. The installation of electronic navigational aids allows an airport to remain open and maintain capacity during times of inclement weather conditions. This minimizes the number of delayed or canceled flights by properly equipped aircraft.

  - **Instrument Landing System (ILS)** – An Instrument Landing System (ILS) is an electronic precision instrument approach system. An ILS is comprised of equipment that allows a pilot to fly an exact course to make a precise landing on a runway. Two components make up an ILS: a glide slope that emits radio waves to keep an aircraft on the correct descent path, and a localizer that keeps an aircraft centered on the runway centerline. Of ground based electronic navigational systems, ILS systems provide the most precision guidance to a runway. At the Airport, an ILS is installed on Runway 35.

    The localizer for Runway 35 can also be utilized for a back course approach to Runway 17. A back course approach utilizes a signal transmitted in the opposite direction from a localizer to conduct an instrument approach. The back course signal can be utilized for horizontal guidance to a runway, however vertical guidance is not provided due to a lack of a glide slope to Runway 17.

  - **Global Positioning System (GPS)** – Aircraft equipped with Global Positioning System (GPS) equipment are able to navigate using signals emitted from satellites instead of ground based equipment to determine their location, altitude, direction of travel, and speed. Aircraft utilizing GPS for approaches to an airport are not reliant on ground based equipment when navigating a non-precision approach. Although still in the early stages of development and installation, ground based GPS equipment installed at airports supplemented by GPS satellites allows an aircraft to perform precision instrument approaches to runways. At the Airport, aircraft are able to utilize GPS to perform non-precision instrument approaches to Runway 17/35 and Runway 5/23.

  - **Very High Frequency Omni-directional Radio Range (VOR)** – Very High Frequency Omni-directional Radio Range (VOR) is a ground based navigational system that emits radio signals in Morse code to allow an aircraft to derive its bearing to determine its location from the VOR. VORs are utilized in non-precision approaches to runways as they do not provide vertical guidance to aircraft. At the Airport, a VOR is located on the airfield between Taxiway A and Taxiway E east of Runway 5/23. Currently at the Airport, instrument approach procedures utilizing the VOR have been developed for Runway 5, Runway 17, Runway 23, and Runway 35.

- **Non-Directional Beacon (NDB)** – A Non-Directional Beacon (NDB) is another radio transmitter that provides an omni-directional signal that can be used in non-precision approaches to runways. The signal emitted from the NDB allows a pilot to track its position to and from the radio receiver. The NDB that serves the Airport is located approximately 6.4 miles south of Runway 35 north of Vicksburg.

1.7.e Buildings – Another component that makes up the infrastructure of the Airport is the various buildings that help support Airport operations. These buildings range from those designed to support the operations of commercial air carriers and general aviation activities, along with supporting operational needs of Airport staff. The following section will inventory the various buildings found at the Airport.

- **Terminal Building –** The Airport recently completed construction of a new terminal to replace the former building which had been renovated and expanded several times since 1958. The new terminal offers several facility upgrades including:

  - An expanded security checkpoint
  - An expanded baggage claim area
  - Additional boarding gates
  - Additional jetbridges
  - Expanded rental car facilities
  - An expanded ticketing lobby
  - An expanded passenger boarding area
  - An enhanced restaurant, gift shop, restrooms, and other passenger amenities

  Increased passenger traffic and the need for more modern facilities that offer greater passenger conveniences led Airport administration and the County of Kalamazoo to seek construction of a new terminal. In June 2009, construction began to replace the former facility that had been in operation since 1958. The new terminal, completed in April 2011, is approximately 59,000 square feet and includes multiple security checkpoint lanes, two baggage claim carrousels, increased space for rental car and airline ticketing counters, expanded lobby and passenger waiting areas, covered jetbridges at each boarding gate, and incorporated a design that offers future building expansion opportunities.

This Master Plan update does not include an extensive analysis of the terminal building since it was recently constructed; however, additional information about the new terminal and the disposition of the former building can be found in Chapters 3, 4 and 5.

- **Control Tower –** At the time of this Master Plan update, the FAA was in the process of constructing a new ATCT to replace the existing structure located on the top of the former terminal building. The new control tower will offer greater airfield visibility to air traffic controllers and provide upgraded amenities and equipment compared to those offered in the existing tower. Its location will be on the east side of the airfield between the approach ends of Runway 23 and Runway 27 and is expected to be completed by 2013. As a result, an analysis of the existing ATCT was not conducted as a part of this project.

1.7.f General Aviation Facilities – Several buildings that support general aviation operations are found at the Airport. These buildings range from aircraft hangars and fixed base operators (FBOs), to fueling and support facilities. The following section will inventory these items.

- **Hangars –** Several hangar buildings for general aviation aircraft are found on the west side of the airfield, south of Runway 9/27 and west of Runway 17/35. These buildings can be accessed on the land side through secured vehicle entrance off of Milham Avenue. These buildings range from traditional T-hangar buildings for individual aircraft to standard box style buildings capable of housing more than one aircraft. Private individuals and small businesses lease hangar space in these buildings and are granted hangar space through a waiting list that is maintained by the Airport.

- **Fixed Based Operator (FBO) –** Four organizations at the Airport offer FBO services for general aviation users. Duncan Aviation, located on the west side of the airfield offers the Airport's sole full-service FBO. Duncan is fully equipped to handle both traditional FBO services such as aircraft fueling, aircraft maintenance and other ground services, along with providing weather equipment and crew rest areas for pilots, passenger services such as rental and courtesy cars, restrooms, vending options, and a lobby waiting area. Duncan's facility also serves as the general aviation terminal at the Airport.

  Kalamazoo Aircraft is another FBO at the Airport providing aircraft maintenance services to single and light twin general aviation aircraft. Kalamazoo Aircraft offers aircraft inspections, maintenance, repairs, and alterations among other services for these aircraft types. A third organization offering FBO services at the Airport is the Kalamazoo Pilots Association that operates a self-serve fueling pump in the hangar area and offers a restroom for pilots. Finally, Aviation Assets conducts a flight training school on the north side of the Airport.

- **Fueling Facilities –** Two fuel farm facilities are located at the Airport in the hangar area on the west side of the Airport off of Milham Avenue. Above and below ground fuel tanks containing Jet A and 100 low lead (100LL) fuels are operated by Duncan Aviation while a smaller 100LL tank operated by the Kalamazoo Pilots Association is located nearby to the north.

1.7.g Support Facilities – Support facilities are those buildings that are necessary for operation of the Airport. These facilities can be vehicle maintenance buildings, aircraft rescue and firefighting (ARFF) facilities, and those necessary for the day to day operation of the Airport. The following section will inventory these facilities found at the Airport.

- **Aircraft Rescue and Fire Fighting (ARFF) –** The Airport's existing ARFF facility is located north of the terminal building and west of Runway 17/35. The ARFF facility has three bays for fire equipment and living and sleeping quarters for fire fighters on duty. The building also has room for the storage of other necessary equipment.

- **Maintenance Buildings –** The Airport has three dedicated buildings for maintenance equipment. A large building with bays for snow removal and other maintenance equipment is located on the east side of the hangar complex on the west side of the airfield. This building also consists of workspaces for maintenance personnel to complete various tasks. Two other smaller maintenance buildings, each located south of the larger building, provide alternative locations for storage of maintenance equipment such as plows and mowing tractors, and supplies necessary for the operation of the Airport.

- **Electrical Vault –** Connected to the large maintenance building is the electrical vault for the Airport. This building houses the Constant Current Regulators (CCRs), transformers, and control equipment necessary for lighting on the airfield.

1.7.h Landside Access – Included in the review of existing facilities is the landside access to the Airport. It is important to assess the landside access in order to improve efficiency in the flow and circulation of vehicle traffic. Airport Drive, the main entrance to the Airport, is located off of Portage Road and circles around the front of the terminal and past the ARFF building. It joins with Fairfield Road to the north where it provides an exit back out to Portage Road. Since Airport Drive is one-way, a service road connecting Fairfield Road with the main Airport entrance allows traffic that has passed the terminal building to circle back around. This is important to allow a continuous traffic flow in front of the terminal building.

1.8 Airport Tenants

A range of businesses and organizations make up the diverse tenant list for the Airport. Tenants are classified as those businesses both whose operations can be directly correlated to aviation activity and those who are non-aeronautical that are based at the Airport. This section reviews the tenants located inside the terminal building and at locations surrounding the airfield.

1.8.a Terminal Building Tenants – Several tenants located in the terminal building who lease space for operations include Delta Air Lines, American Eagle, Direct Air, the Federal Aviation Administration (FAA) and the Transportation Security Administration (TSA). Five rental car companies (Avis, Budget, Enterprise, Hertz and National/Alamo) also lease counter space near the baggage claim to conduct their operations. Leisure Limousine & Sedan located near the baggage claim entrance also provides ground transportation options for passengers. Show Time Cafe and Old Fisherman's Pub are two food and beverage tenants located near the security checkpoint. Other tenants found inside the terminal building include a real estate company, shoeshine stand, ATM, visitor's information booth, skycaps and Jet Transit Air Freight.

1.8.b Airfield Tenants – Other major tenants located at the Airport are found on the airfield. Mott Aviation operates a hangar near the Airport entrance off of Portage Road for its private charter operation. Duncan Aviation's operation is located south of Riley Aviation on Portage Road. Hinman Company manages a hangar formerly occupied by Pfizer south of Duncan Aviation. The Kalamazoo Aviation History Museum, or Air Zoo, has hangars on the east side of the airfield used for display of vintage aircraft and for aircraft refurbishment for its museum displays. Kalamazoo Aircraft's hangar is located on the south end of the hangar area off of Milham Avenue. Finally, AZO, LLC conducts aircraft retrofit operations on the north side of the airfield out of the former Western Michigan University College of Aviation facility.

It should be noted that three airfield tenants have direct access to the airfield, known as through-the-fence operations. Through-the-fence operations are those privately held properties whose operations or activities have direct access to the airfield. The three tenants with through-the-fence operations are the Hinman Company with a corporate hangar on the west side of the airfield, the Kalamazoo Aviation History Museum with a maintenance/restoration facility directly to the east and AZO, LLC with an aircraft maintenance, restoration, sales, and rental operation on the north side of the airfield.

1.9 Airspace and Air Traffic Control

In this section, the airspace and air traffic control around the Airport are inventoried. Several elements that make up the airspace and air traffic control are discussed in more detail in the following section, and relationships between these elements and the Airport are explored.

1.9.a Airspace – Airspace over the United States is defined by the FAA and classified into six categories. Each category is assigned over a section of airspace that has a special condition, i.e. a high activity level or control tower. Special restrictions and/or operating rules apply to each classification of airspace. The following describes the six categories of airspace:

- **Class A –** Class A airspace is located between altitudes of 18,000 feet and 60,000 feet. Aircraft operating in this airspace must operate under Instrument Flight Rules (IFR) and file a flight plan. Radio communication and approval from air traffic control is required for all aircraft in this airspace.

- **Class B –** Class B airspace is located between ground level and an altitude of 10,000 feet and is generally classified around the busiest airports in terms of amount of air traffic. The dimension of Class B airspace varies due to the specific needs of each airport. Aircraft operating in this airspace must receive clearance and be in contact with air traffic control.

- **Class C –** Class C airspace is located between ground level and an altitude of 4,000 feet and is classified around airports that have a control tower, radar approach control and have a certain number of IFR operations. The dimension of Class C airspace also varies by specific needs of an airport but is usually a five mile radius around an airport until a height of 1,200 feet where an outer radius of ten (10) miles extend to 4,000 feet in altitude. Radio communication with air traffic control is required for aircraft to enter and operate in this airspace.

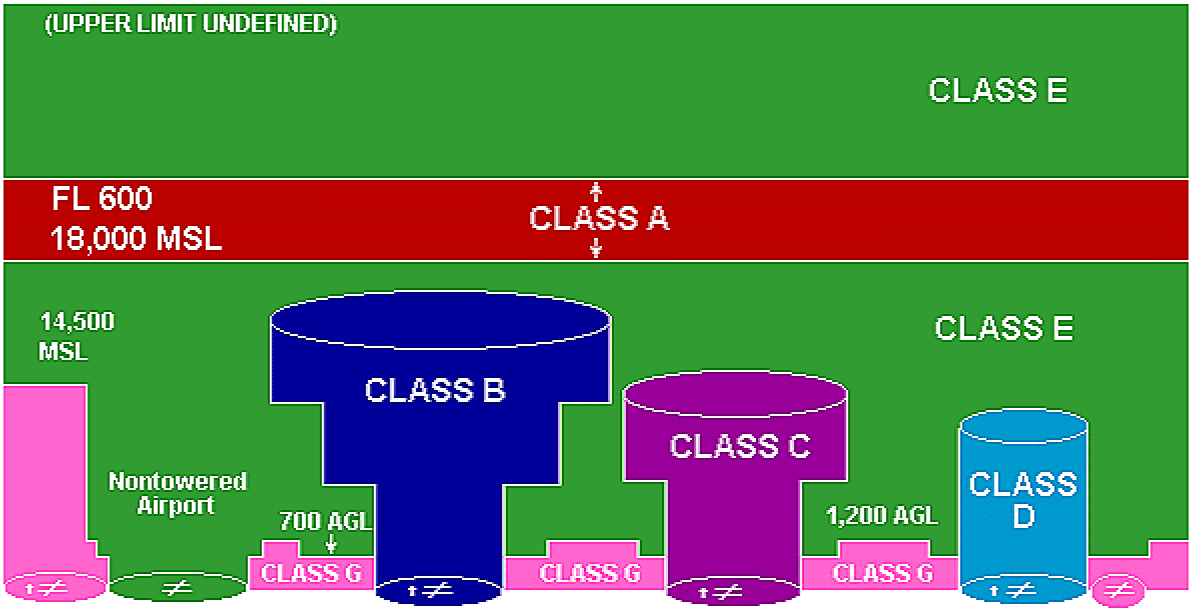
- **Class D –** Class D airspace is located between ground level and an altitude of 2,500 feet and is classified around airports with only an operational control tower. The dimension of Class D airspace is also tailored to meet the needs of the airport and communication with air traffic control is required to enter and operate in the airspace.

- **Class E –** Class E airspace is all airspace between ground level and 18,000 feet not classified as A, B, C, D, or G. Only aircraft operating under Visual Flight Rules (VFR) in this airspace are not required to be in communication with air traffic control. Aircraft operating under IFR are required to be in communication with air traffic control.

- **Class G –** Class G airspace is uncontrolled airspace located between ground level and an altitude of 14,500 feet. Air traffic control is not provided in these airspaces. Though generally found between ground level and approximately 1,200 feet in altitude, Class G airspace can also be classified around large, remote areas.

Airspace that surrounds the Airport is classified as Class D with an associated Terminal RADAR Service Area (TRSA), requiring all aircraft that enter or operate in it to be in communication with air traffic control. This classification of airspace is assigned as the Airport has an air traffic control tower, a radar approach control and based on the number of IFR operations that are conducted. **Figure 1-5** illustrates the different classes of airspace while **Figure 1-6** illustrates the airspace around the Airport.

Figure 1-5
Classes of Airspace



Source: Federal Aviation Administration

Figure 1-6
Airspace Sectional Chart

Source: SkyVector.com Aeronautical Charts, 2009

1.9.b Part 77 Surfaces – In an effort to identify obstructions for aircraft operating an at airport, Federal Aviation Regulation (FAR) Part 77 was established by the FAA which defines a set of surfaces around an airport which are to remain clear of tall objects. Although FAR Part 77 defines surfaces and allowable heights of objects in proximity to an airport, it does not allow the FAA to authorize land use surrounding an airport. The objective of FAR Part 77 is to determine if existing and proposed objects could be obstructions to aircraft; it does not give the FAA the authority to allow or prohibit specific uses. Five surfaces are defined in FAR Part 77 that are described in greater detail in Chapter 3. These five surfaces as illustrated in **Figure 1-7** include:

- **Primary Surface –** The primary surface is centered longitudinally on the runway centerline and is the same elevation as the runway. On paved runways, the primary surface extends 200 feet beyond each runway end while on turf runways the surface ends at the same length of the runway. The width of this surface is:

    - 250 feet for utility runways having only visual approaches
    - 500 feet for utility runways having non-precision instrument approaches

  For runways other than utility runways, the width is:

    - 500 feet for visual runways having only visual approaches
    - 500 feet for non-precision instrument runways having visibility minimums greater than three-fourths statue mile
    - 1,000 feet for a non-precision instrument runway having a non-precision instrument approach with visibility minimums as low as three-fourths a statue mile
    - 1,000 feet for precision instrument approach runways

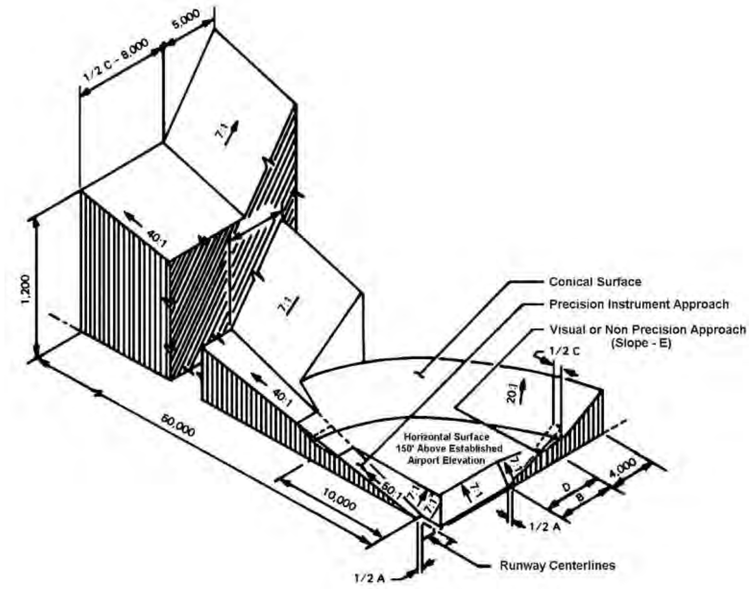
- **Approach Surface** – The approach surface is centered on the runway centerline and extends longitudinally outward and upward from the primary surface at each runway end. The slope of the surface is dependant upon the type of approach to the runway. It can slope upwards at a ratio of 20:1, 34:1, or 50:1 and outwards to lengths of 5,000 to 50,000 feet.

- **Transitional Surface** – The transitional surface is also centered on the runway centerline but extends outward and upward perpendicularly from the primary surface that encompasses the runway. This surface slopes outward at a ratio of 7:1 until it meets the horizontal surface at a height of 150 feet above an airport.

- **Horizontal Surface –** The horizontal surface is a horizontal plane located 150 feet above an airport between the transitional surface and the conical surface. The perimeter of this surface is constructed by connecting arcs generated from each runway end through lines of tangent. The radii of the arcs vary from 5,000 feet for utility and visual runways to 10,000 feet for all other runways.

- **Conical Surface –** The conical surface extends outward and upward from the perimeter of the horizontal surface. The slope of the conical surface extends upward at a 20:1 ratio for a horizontal distance of 4,000 feet.

Figure 1-7
FAR Part 77 Surfaces



Source: National Geodetic Survey (NGS), 2009

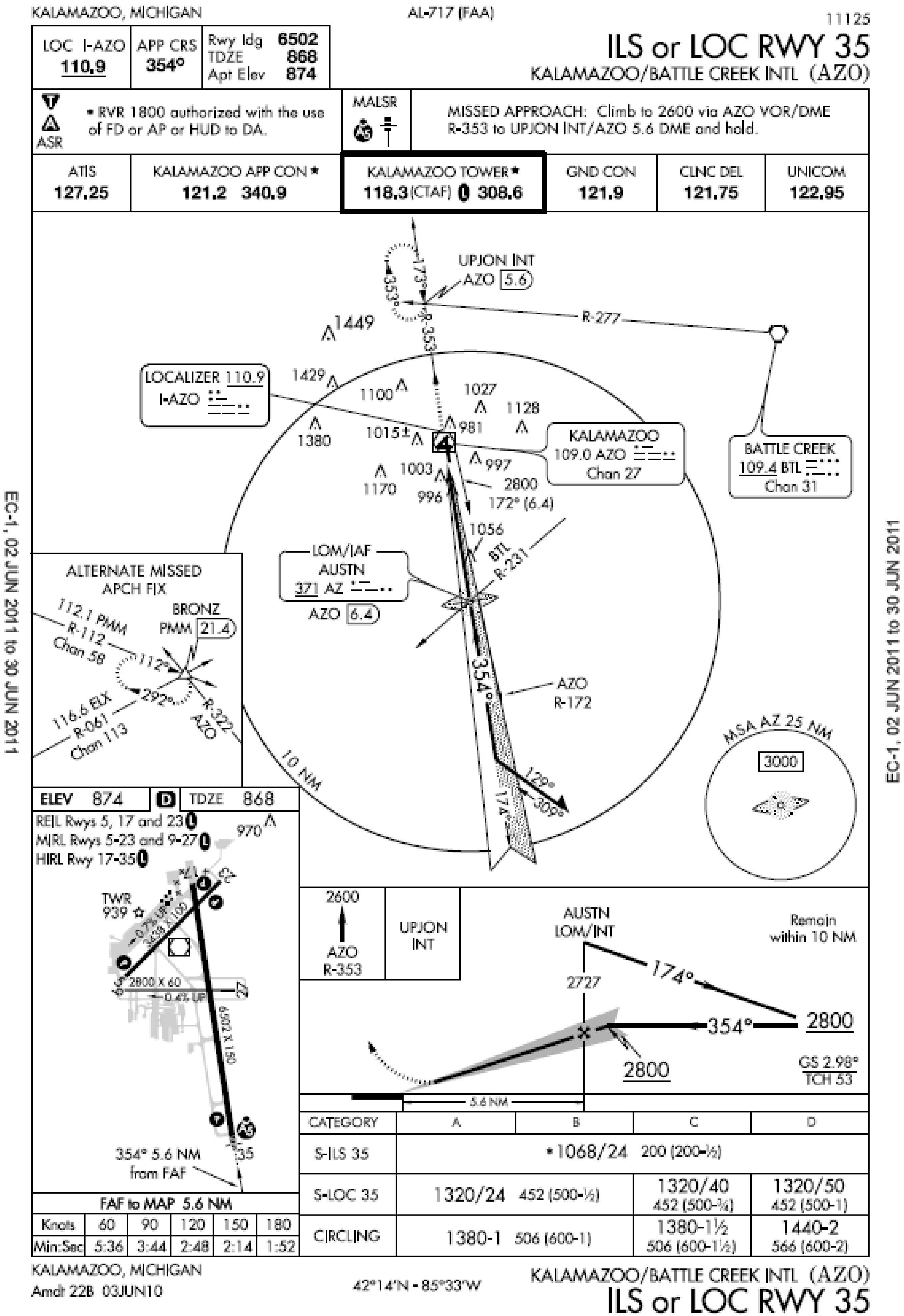
1.9.c Published Approach Procedures – In order for pilots to effectively navigate airspace during landing, approach procedures are established. The FAA establishes approach procedures for runways with precision and non-precision navigational equipment to assist pilots when operating under IFR conditions. These approach procedures assist pilots in conducting safe landings during low visibility, low ceilings, and inclement weather situations by providing waypoints for runway alignment, specific altitudes, and other navigational information such as radio frequencies and minimum visibility requirements.

Approach procedures are based on the type of navigational equipment installed on each runway. Approach procedures are commonly established for runways equipped with an ILS. These same ILS approach procedures may also be navigated utilizing the localizer, a component of an ILS that aligns aircraft with the centerline of a runway. Approach procedures are also developed utilizing VORs, which are pieces of radio equipment that transmit location and distance information to pilots. Approach procedures can also be developed for runways without ground based navigational equipment utilizing satellite navigation. Area Navigation (RNAV) is a form of aircraft navigation that is based on signals transmitted from global positioning system (GPS) satellites.

The following pages illustrate the published approach procedures that have been established at the Airport as of June 2010:

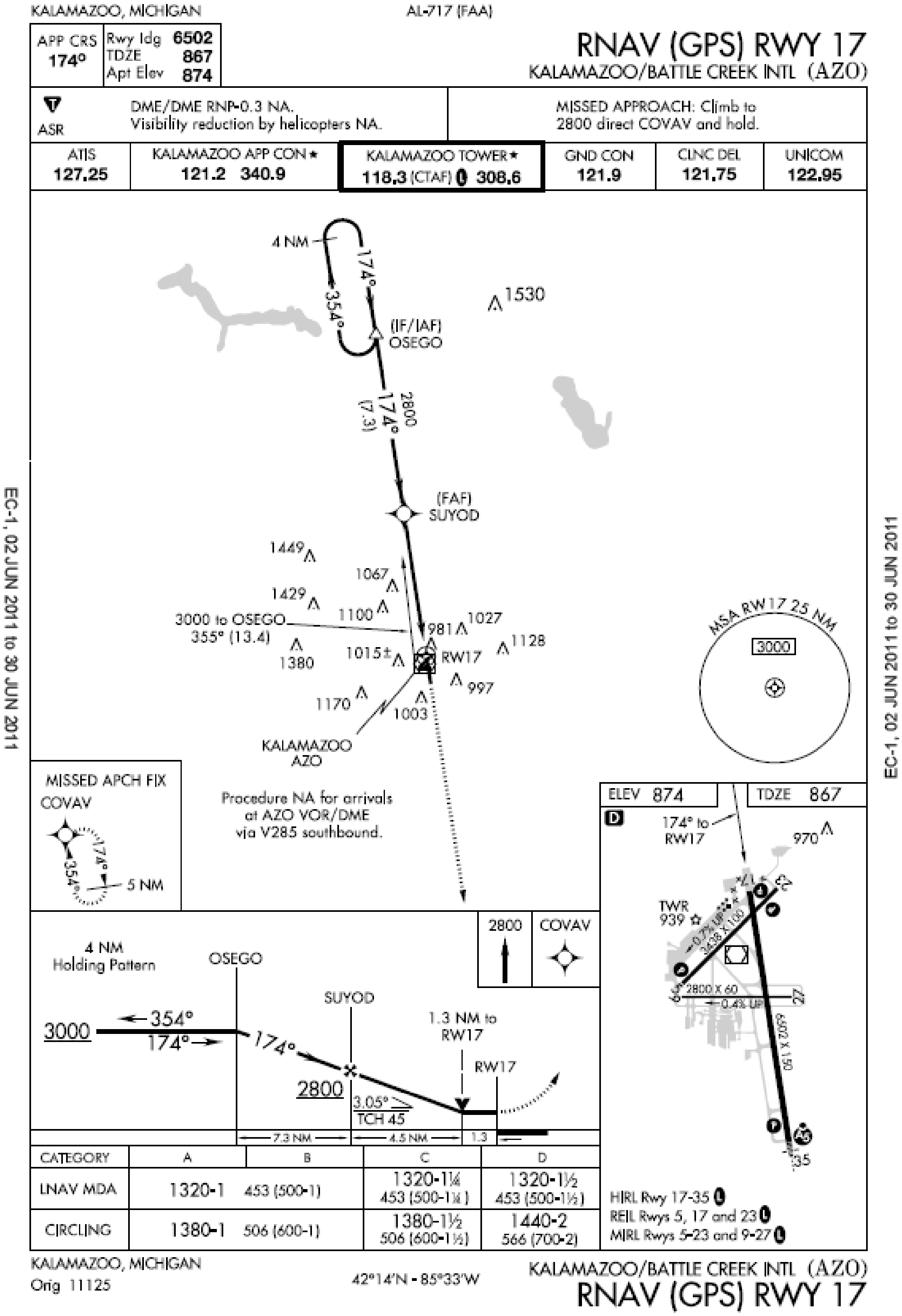
- ILS or localizer approach to Runway 35 (illustrated in **Figure 1-8**)
- Area navigation (RNAV) GPS approach to Runway 17 (illustrated in **Figure 1-9**)
- RNAV (GPS) approach to Runway 35 (illustrated in **Figure 1-10**)
- RNAV (GPS) approach to Runway 5 (illustrated in **Figure 1-11**)
- RNAV (GPS) approach to Runway 23 (illustrated in **Figure 1-12**)
- Back course localizer approach to Runway 17 (illustrated in **Figure 1-13**)
- VOR approach to Runway 5 (illustrated in **Figure 1-14**)
- VOR approach to Runway 17 (illustrated in **Figure 1-15**)
- VOR approach to Runway 23 (illustrated in **Figure 1-16**)
- VOR approach to Runway 35 (illustrated in **Figure 1-17**)
- NDB approach to Runway 35 (illustrated in **Figure 1-18**)

Figure 1-8
Runway 35 ILS or Localizer Approach



Source: Federal Aviation Administration

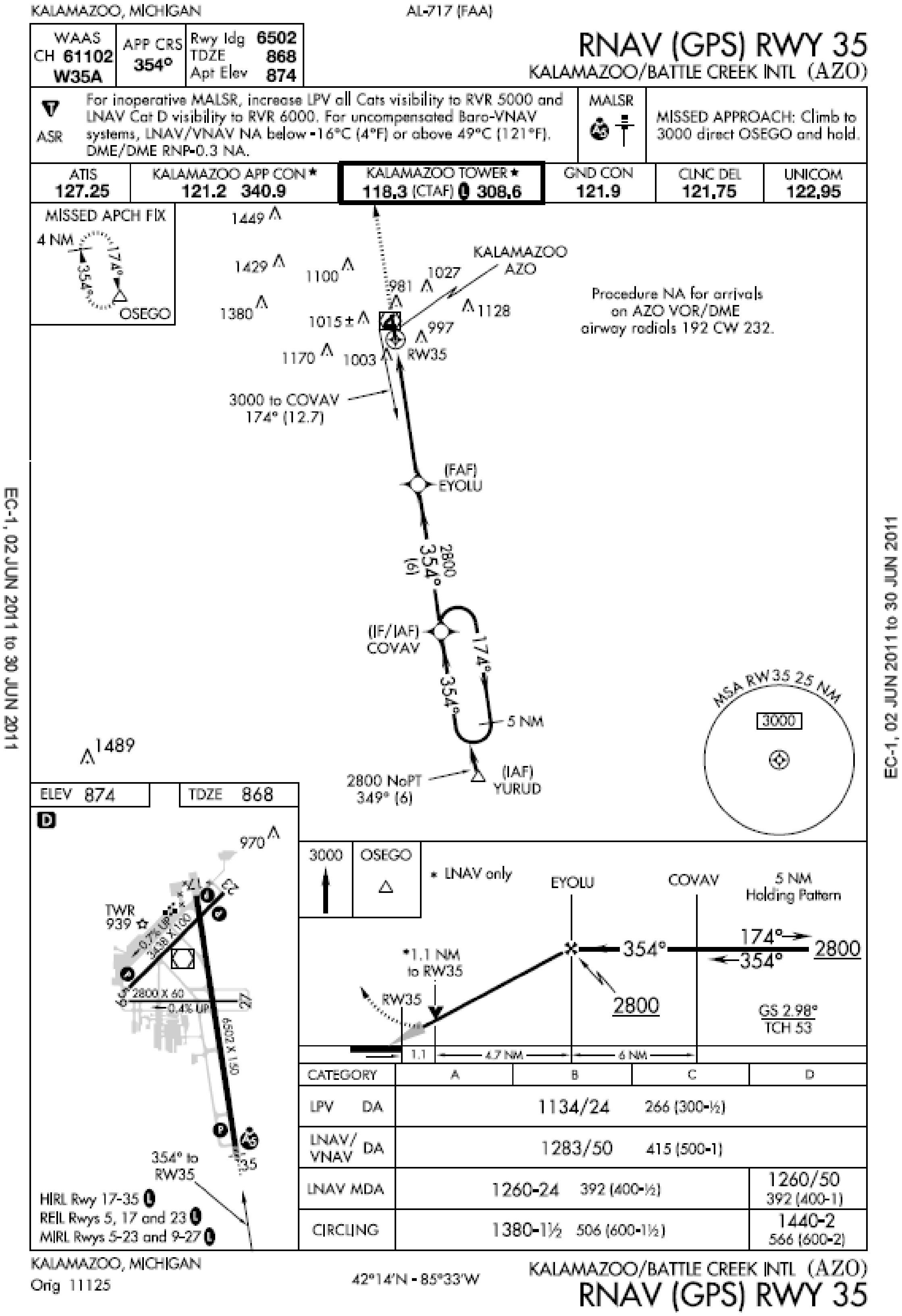
Figure 1-9
Runway 17 RNAV (GPS) Approach



CATEGORY	A	B	C	D
LNAV MDA	1320-1	453 (500-1)	1320-1¼ 453 (500-1¼)	1320-1½ 453 (500-1½)
CIRCLING	1380-1	506 (600-1)	1380-1½ 506 (600-1½)	1440-2 566 (700-2)

Source: Federal Aviation Administration

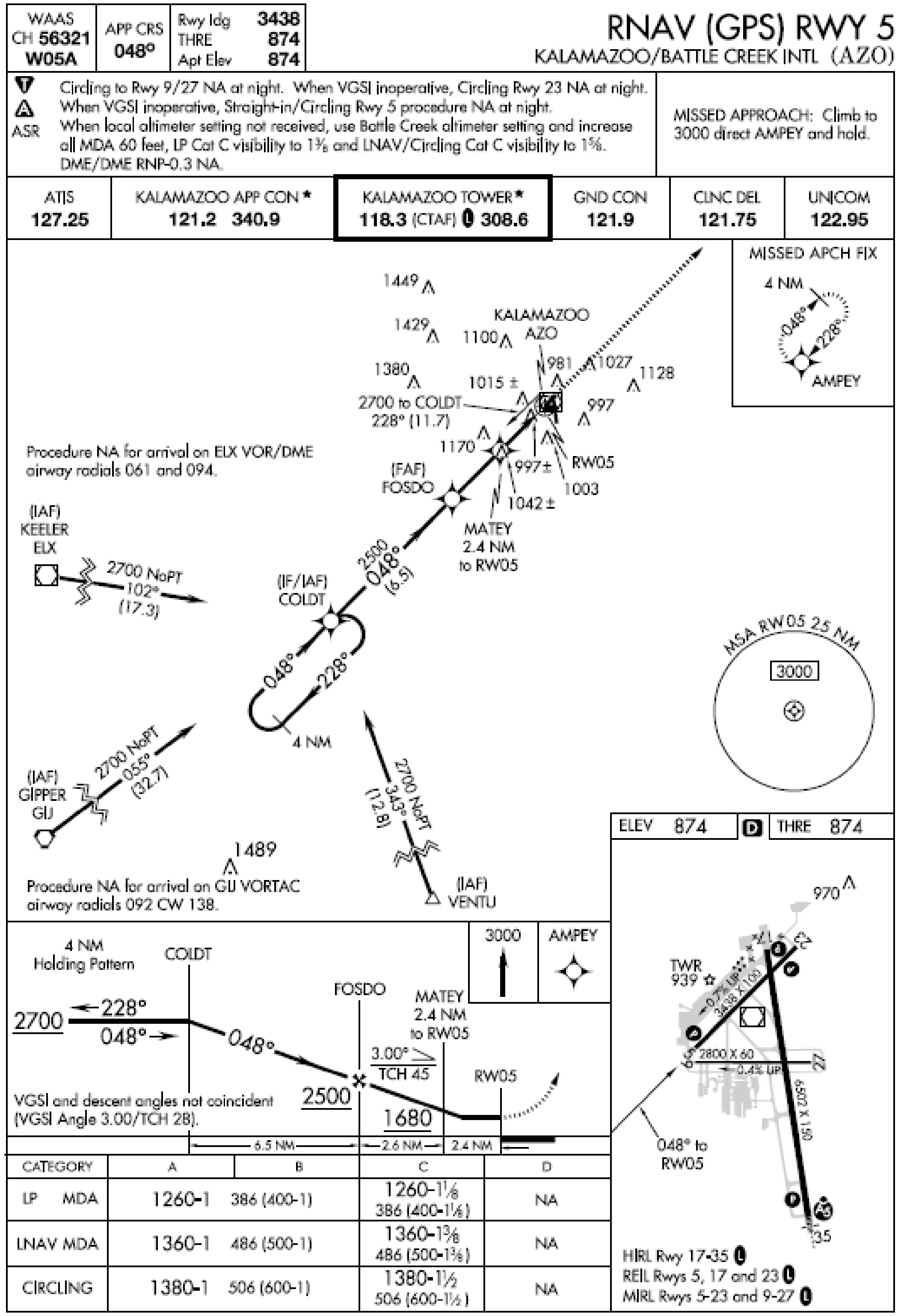
Figure 1-10
Runway 35 RNAV (GPS) Approach



CATEGORY	A	B	C	D
LPV DA	1134/24 266 (300-½)			
LNAV/VNAV DA	1283/50 415 (500-1)			
LNAV MDA	1260-24 392 (400-½)			1260/50 392 (400-1)
CIRCLING	1380-1½ 506 (600-1½)			1440-2 566 (600-2)

Source: Federal Aviation Administration

Figure 1-11
Runway 5 RNAV (GPS) Approach



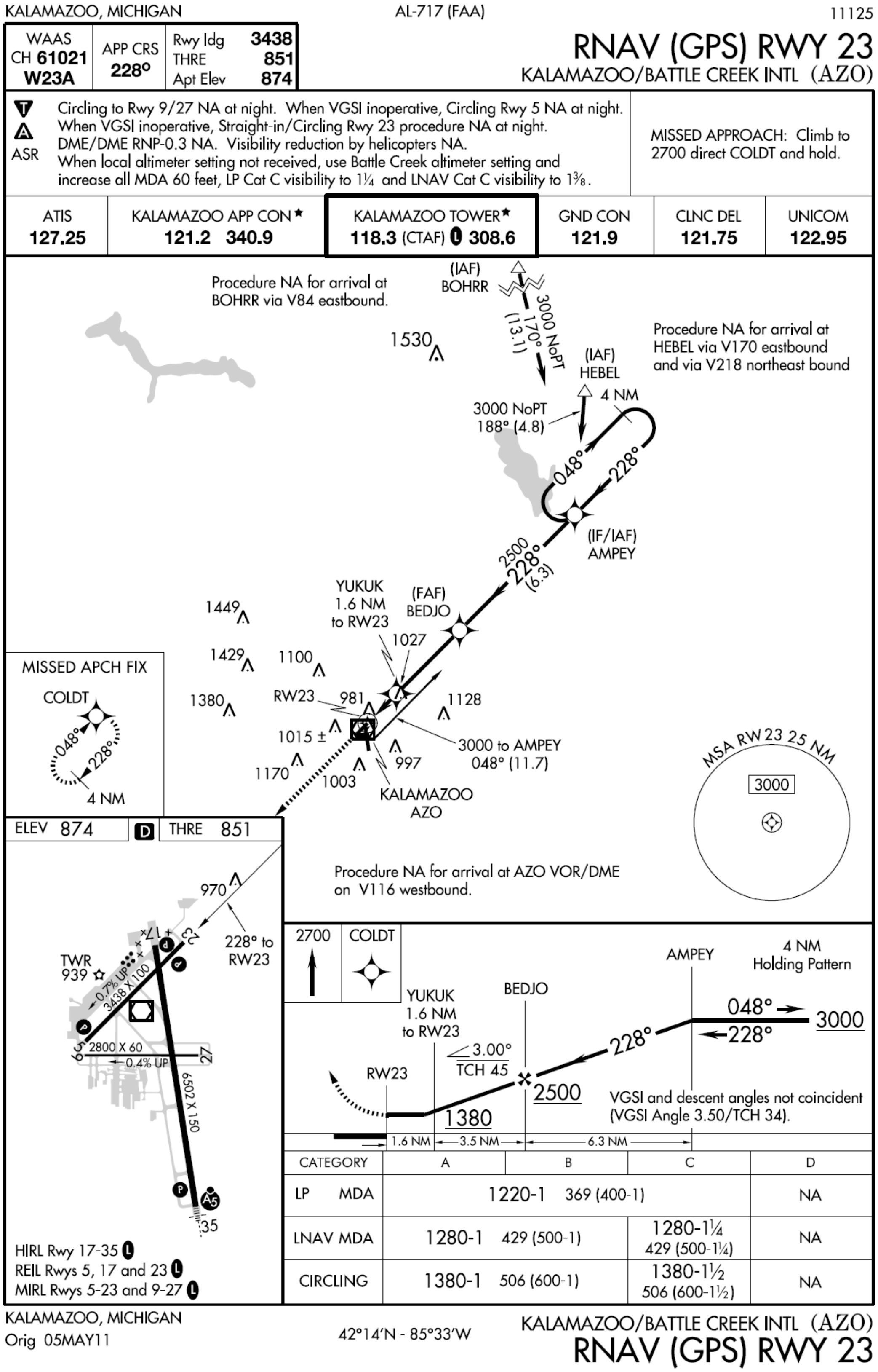
CATEGORY	A	B	C	D
LP MDA	1260-1	386 (400-1)	1260-1⅛ 386 (400-1⅛)	NA
LNAV MDA	1360-1	486 (500-1)	1360-1⅜ 486 (500-1⅜)	NA
CIRCLING	1380-1	506 (600-1)	1380-1½ 506 (600-1½)	NA

KALAMAZOO, MICHIGAN
Orig 05MAY11
42°14'N - 85°33'W
KALAMAZOO/BATTLE CREEK INTL (AZO)
RNAV (GPS) RWY 5

EC-1, 02 JUN 2011 to 30 JUN 2011

Source: Federal Aviation Administration

Figure 1-12
Runway 23 RNAV (GPS) Approach



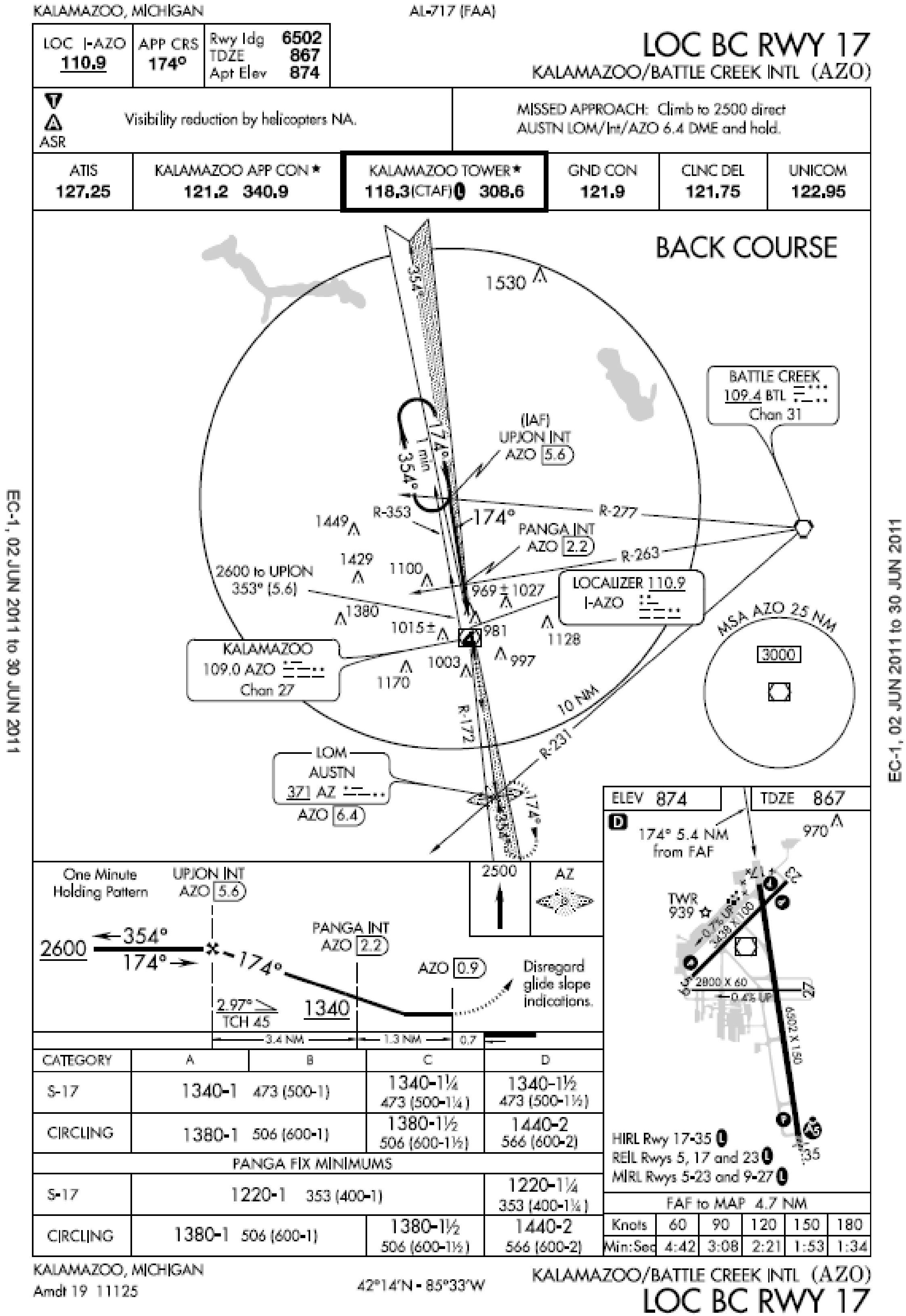
CATEGORY	A	B	C	D
LP MDA	1220-1 369 (400-1)			NA
LNAV MDA	1280-1 429 (500-1)		1280-1¼ 429 (500-1¼)	NA
CIRCLING	1380-1 506 (600-1)		1380-1½ 506 (600-1½)	NA

KALAMAZOO, MICHIGAN
Orig 05MAY11
42°14'N - 85°33'W
KALAMAZOO/BATTLE CREEK INTL (AZO)
RNAV (GPS) RWY 23

EC-1, 02 JUN 2011 to 30 JUN 2011

Source: Federal Aviation Administration

Figure 1-13
Runway 17 Back Course Localizer Approach

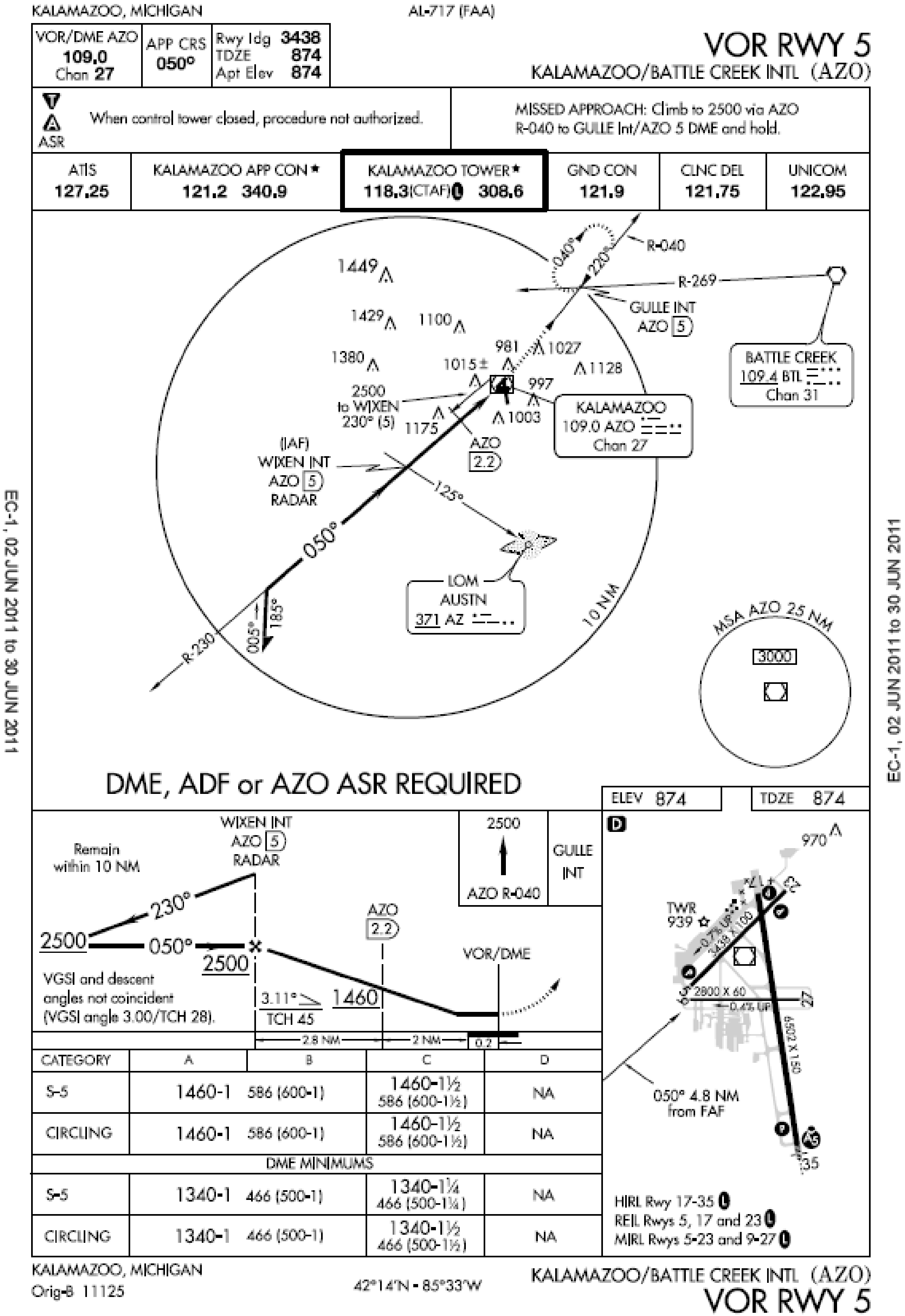


CATEGORY	A	B	C	D
S-17	1340-1 473 (500-1)		1340-1¼ 473 (500-1¼)	1340-1½ 473 (500-1½)
CIRCLING	1380-1 506 (600-1)		1380-1½ 506 (600-1½)	1440-2 566 (600-2)
PANGA FIX MINIMUMS				
S-17	1220-1 353 (400-1)			1220-1¼ 353 (400-1¼)
CIRCLING	1380-1 506 (600-1)		1380-1½ 506 (600-1½)	1440-2 566 (600-2)

Knots	60	90	120	150	180
Min:Sec	4:42	3:08	2:21	1:53	1:34

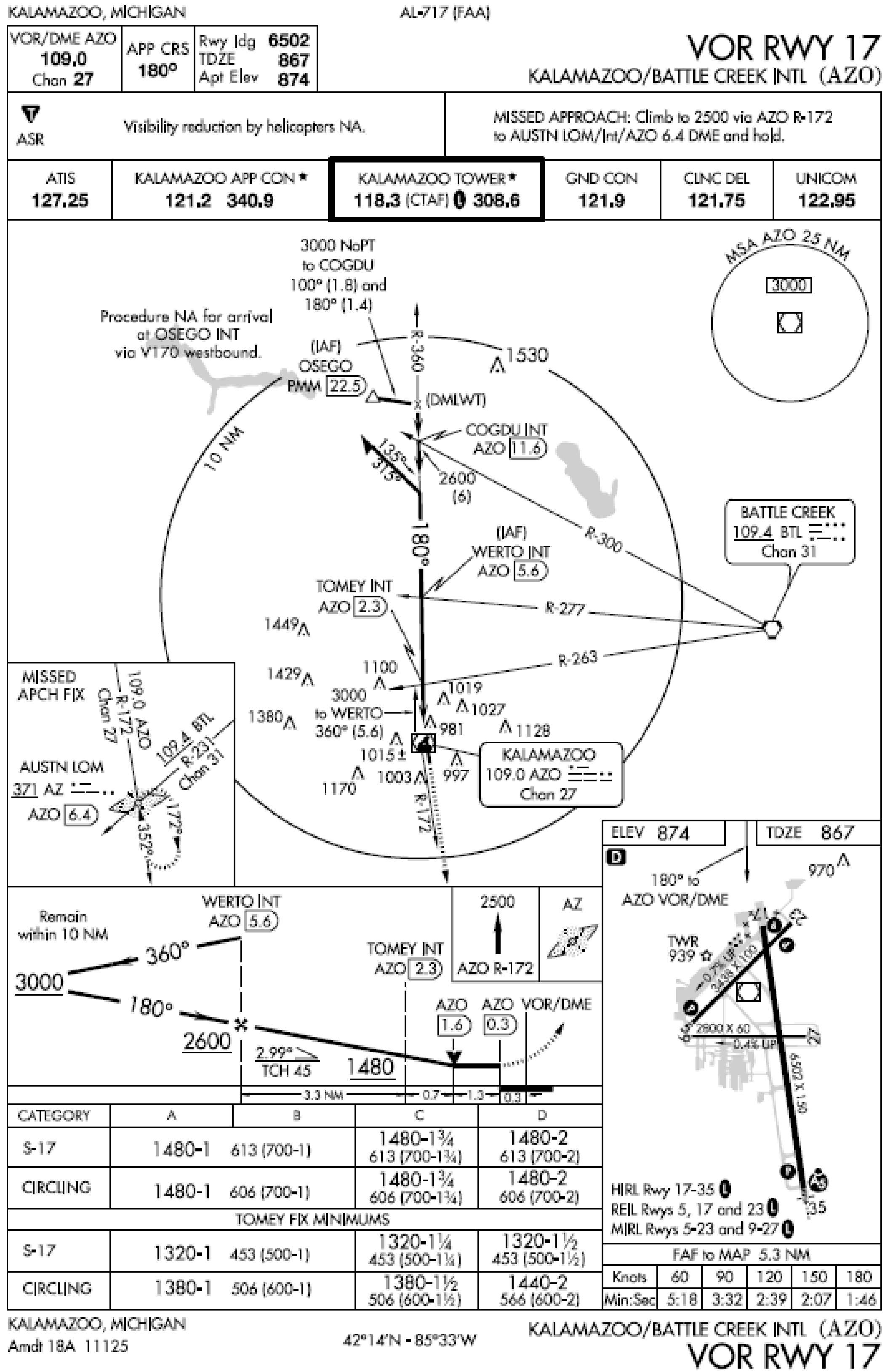
Source: Federal Aviation Administration

Figure 1-14
Runway 5 VOR Approach



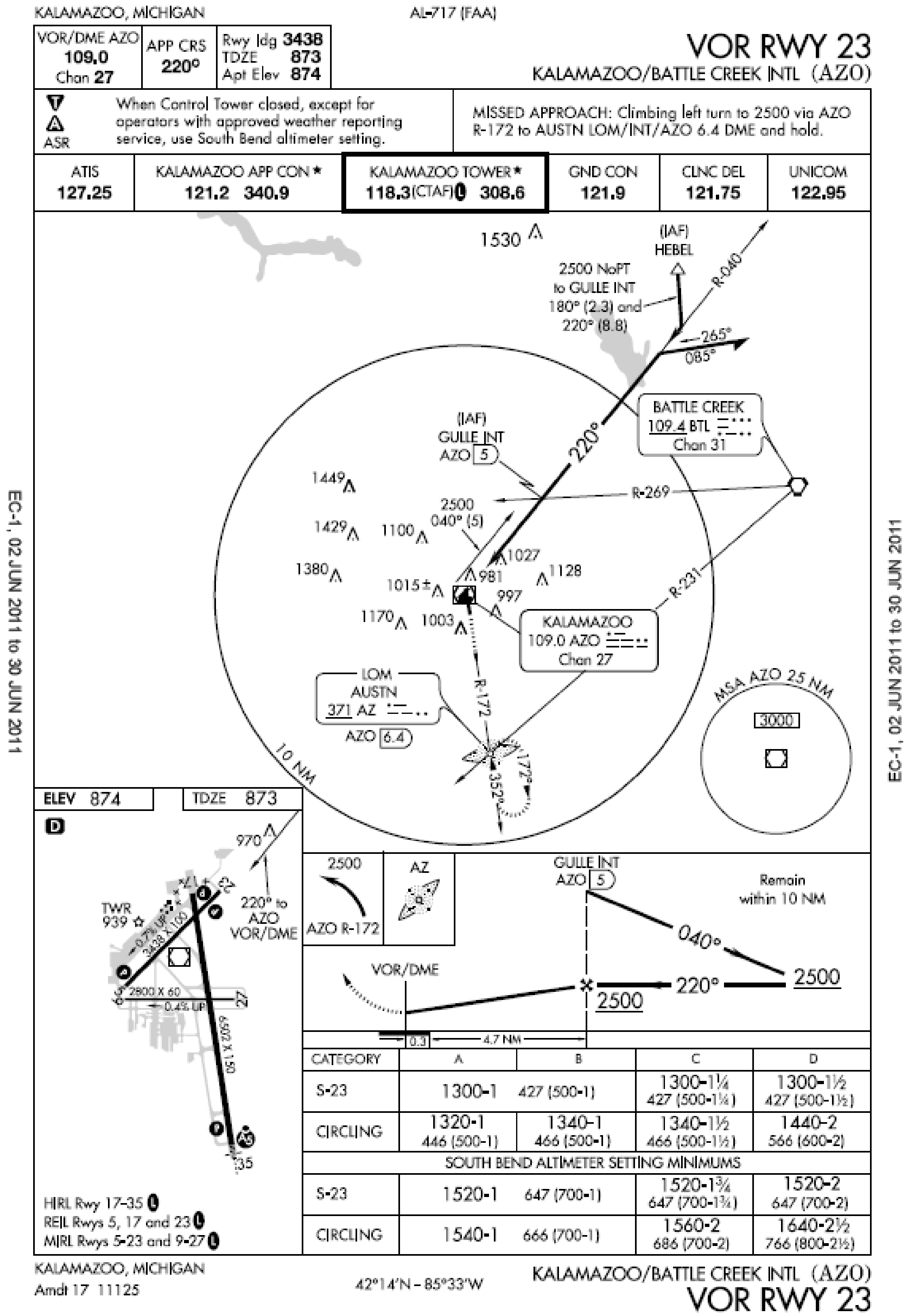
Source: Federal Aviation Administration

Figure 1-15
Runway 17 VOR Approach



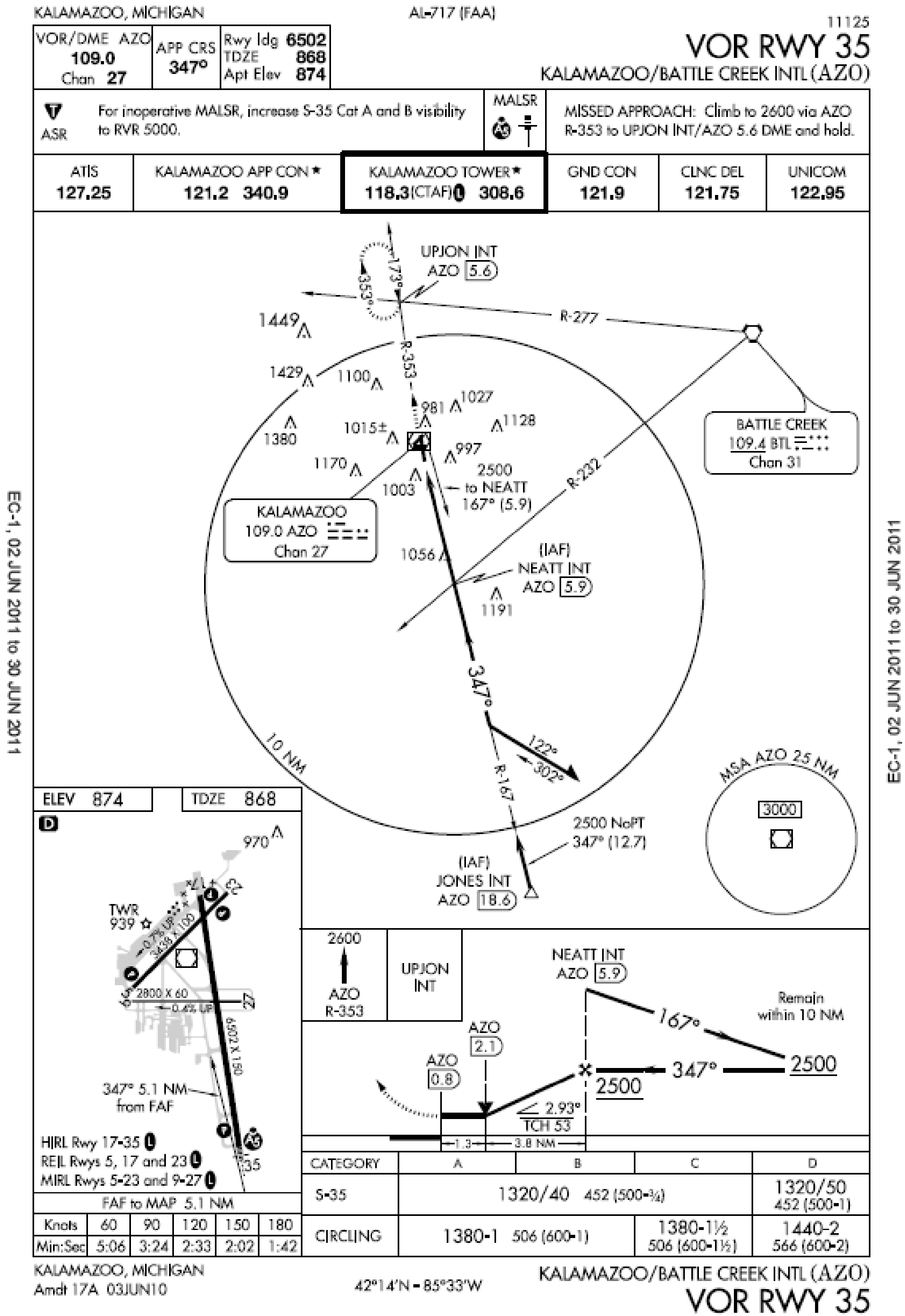
Source: Federal Aviation Administration

Figure 1-16
Runway 23 VOR Approach



Source: Federal Aviation Administration

Figure 1-17
Runway 35 VOR Approach



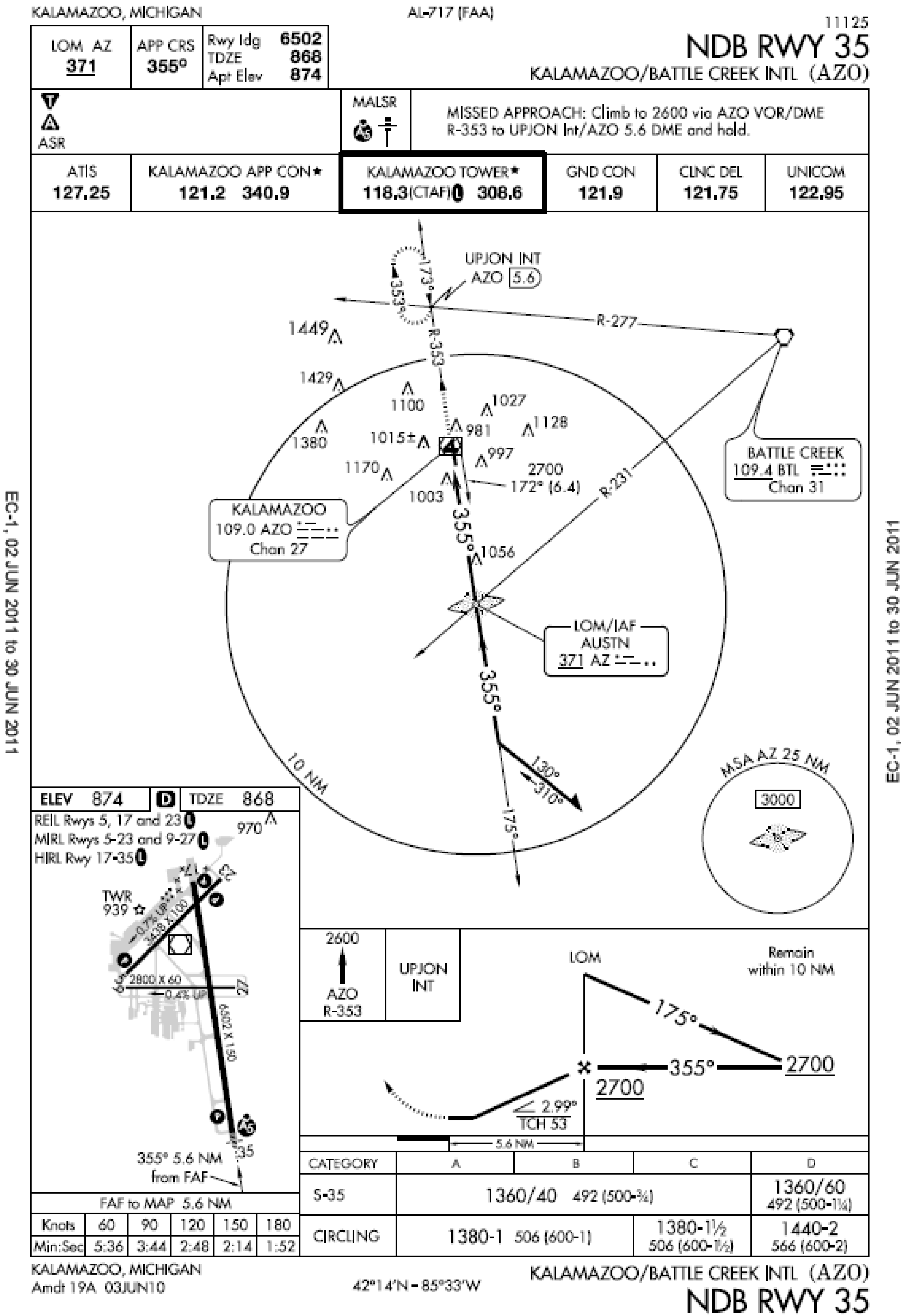
FAF to MAP 5.1 NM				
Knots	60	90	120	150	180
Min:Sec	5:06	3:24	2:33	2:02	1:42

CATEGORY	A	B	C	D
S-35	1320/40 452 (500-¾)			1320/50 452 (500-1)
CIRCLING	1380-1 506 (600-1)		1380-1½ 506 (600-1½)	1440-2 566 (600-2)

KALAMAZOO, MICHIGAN
Amdt 17A 03JUN10
42°14'N - 85°33'W
KALAMAZOO/BATTLE CREEK INTL (AZO)
VOR RWY 35

Source: Federal Aviation Administration

Figure 1-18
Runway 35 NDB Approach



Source: Federal Aviation Administration

1.9.d Air Traffic Control – Air traffic control within the United States is the responsibility of the FAA through the FAA Act of 1958. This Act grants control of the safe separation of air traffic in navigable airspace to the FAA. At the Airport, local air traffic control is managed by an on-site FAA operated ATCT and a TRACON center. The ATCT is responsible for the local control of air traffic within the traffic pattern and responsible for control of the movement of aircraft and vehicles on the airfield. The TRACON facility is responsible for the separation of air traffic arriving, departing, and in transit to the airspace in proximity of the Airport. The ATCT and TRACON facilities manage traffic in the Class D airspace between the hours of 6:00 a.m. to 11:00 p.m. daily.

When the ATCT is operational, airspace within a 4.1 nautical mile radius of the Airport from the surface to and including 3,400 feet mean sea level (MSL) or 2,500 feet above ground level (AGL) is designated as Class “D” airspace. Between 11:00 p.m. and 6:00 a.m. daily, airspace designated as Class “D” reverts to Class “E” airspace. Within Class “E” airspace pilots utilize a Common Traffic Advisory Frequency (CTAF). A CTAF is a frequency designed for the purpose of carrying out airport advisory practices while navigating to or from an airport without an operating control tower. During these times, the safe separation of aircraft is the responsibility of the pilots requiring them to communicate their position to each other on the CTAF frequency. When ATCT and TRACON services resume operation at 6:00 a.m., the airspace surrounding the Airport reverts to Class D.

During hours of operation, the Kalamazoo TRACON provides both Basic and Terminal Radar Service Area (TRSA) radar services to aircraft operating within approximately 40 nautical miles of Kalamazoo from the surface to and including 10,000 feet MSL. Outside of these hours, basic radar services are provided by the Chicago Air Route Traffic Control Center (Chicago ARTCC) facility located in Aurora, Illinois. Both the Kalamazoo TRACON the Chicago ARTCC are responsible for adjusting the flow of arriving IFR and VFR aircraft into traffic patterns in a safe and orderly manner. They also provide traffic advisories for departing VFR aircraft, disseminate safety alerts and traffic advisories, and provide limited radar vectoring when requested by pilots. TRSA service provides, in addition to basic radar service, sequencing of all IFR and participating VFR aircraft to the primary airport and separation between all participating VFR aircraft and all IFR aircraft operating within the TRSA.

Services provided by ATCT and TRACON are divided into operational disciplines to allow for specialized attention for each phase of flight. The following are the operational disciplines offered by air traffic control at the Airport:

- **Clearance Delivery –** Clearance Delivery within the ATCT processes and forwards flight plans, issues clearances, observes and reports weather information, and disseminates weather related airport specific information which may be pertinent to aircraft or vehicles operating to/from or on the Airport. Clearance Delivery may be contacted by pilots on frequency 121.75 megahertz (MHz).

- **Ground Control –** The ground control position with ATCT is responsible for the safe movement of aircraft and vehicles to and from their destinations on the airfield. Along with providing taxiing instructions to aircraft, ground control also is responsible for the safe passage of vehicles and ground equipment within the movement area. Movement areas are defined as the runways, taxiways and other areas of an airport/heliport which are utilized for taxiing/hover taxiing, air taxiing, takeoff and landing of aircraft, exclusive of loading ramps and parking areas. All aircraft and vehicles are required to be in contact with ground control on the frequency of 121.9 MHz when entering and operating within the movement area.

- **Tower –** The tower controller position is responsible for the safe separation of aircraft arriving and departing from the Airport. Along with providing landing and takeoff clearances, this position also is responsible for the safe separation of aircraft within the traffic pattern. Tower controllers are contacted on frequency 118.3 MHz which also serves as the CTAF frequency outside of normal hours of operation.

- **Approach/Departure Control –** The approach/departure controller are positions within TRACON that are responsible for the safe separation of arriving, departing, and transient aircraft through a designated airspace surrounding an airport. These positions may be combined and monitored by a single controller or be divided among several controllers depending upon traffic volume and available staffing. At the Airport, these positions are combined and are the responsibility of a single controller. Aircraft entering or operating east of the Airport's Class D airspace contact this controller on frequency 119.2 MHz while aircraft entering or operating west of the Airport utilize frequency 121.2 MHz.

1.10 Summary

The history of the Airport has shown how it has evolved over its 85 year history to meet the demands of its users. Growing from a grass airstrip to a facility that serves over 400,000 total passengers annually, development actions undertaken by the Airport has allowed it to meet the air transportation requirements of southwest Michigan. In determining infrastructure improvements that may be necessary to meet future aviation demand, existing conditions must be assessed. Review of the facilities and services presented in this Chapter in comparison with projected future activity levels provides a method to evaluate the infrastructure improvements that may be necessary to meet the demand of Airport users for the next twenty years.

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Chapter 2
Projections of Aviation Demand

2

Projections of Aviation Demand

This Chapter focuses on projections of aviation demand. Projections of short, intermediate, and long-term activity are based on five-year forecasts from 2015 to 2030. The forecasts were prepared in 2010, therefore year 2009 serves as the base year for these forecasts since this was the most recent year for which a full 12 months of activity data was available. Data used to compile the forecasts is gathered from multiple sources including Airport master records, industry databases, and the Federal Aviation Administration (FAA) Terminal Area Forecasts (TAF) which is the official forecast database of the FAA.

Projecting future aviation demand is an important element in the master planning process since this data is utilized in several key analyses. Most notably, these projections of aviation demand are used in the evaluation of existing infrastructure capacity and its ability to meet future demand. Additionally, infrastructure improvements that may be necessary in the future are determined through the evaluation of these forecasts. This data is also used to determine the future role of an according to the anticipated aircraft types it would be supporting.

The following outlines the projections, forecasting methodologies, and industry trends that are presented in this Chapter:

- 2.1 Role of the Airport
- 2.2 Industry Trends
- 2.3 Critical Aircraft
- 2.4 Forecasting Approach
- 2.5 Passenger Enplanement Projections
- 2.6 Commercial Air Carrier Operations and Fleet Mix Projections
- 2.7 Military Operations Projections
- 2.8 General Aviation Activity Projections
- 2.9 Instrument Operations
- 2.10 Air Cargo Projections
- 2.11 Aviation Demand Peaking Characteristics
- 2.12 Aviation Demand Summary – FAA Comparison

2.1 Role of the Airport

Before projecting future aviation demand, it is important to first understand the role of the Airport on a regional, statewide, and national level. Along with serving the general aviation (GA) needs of southwest Michigan, the Airport also plays an important role in the aviation systems of Michigan and the United States by offering commercial air service. The following will break down the local, state, and national roles of the Airport.

2.1.a Regional Role – The centralized location of the Airport allows it to serve several communities throughout southwest Michigan region, and contribute to the regional economy. The Airport serves this region as the primary commercial air service facility, and also serves GA users in the area by providing maintenance, repair, and service facilities for GA aircraft throughout the southwest Michigan region.

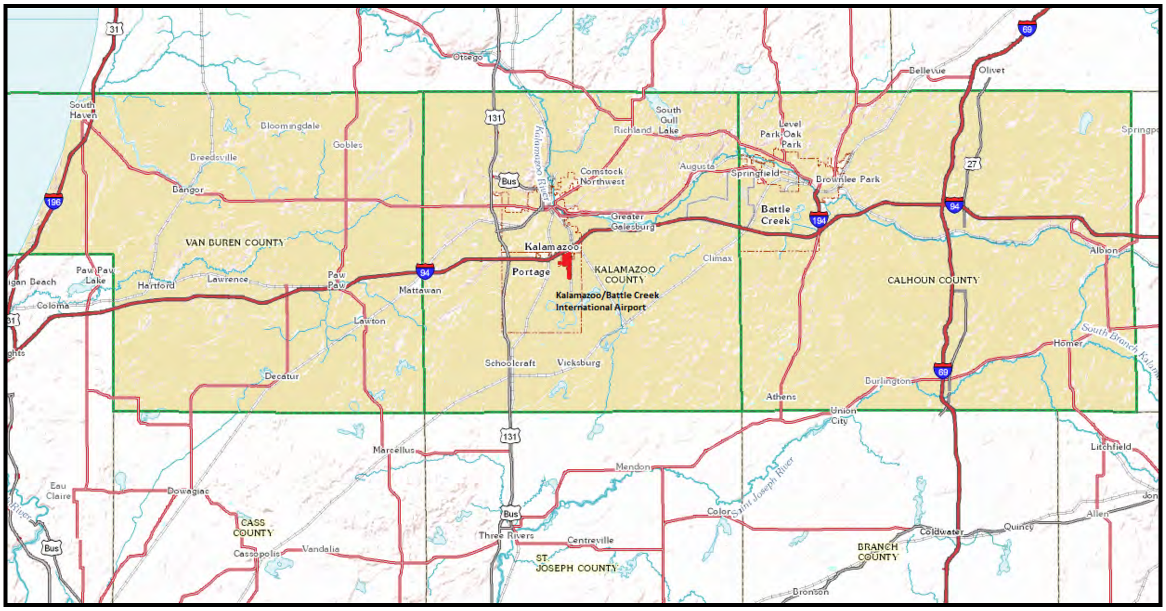
2.1.b State of Michigan Role – Within the Michigan Airport System Plan (MASP), which was developed in 2008, the Airport is classified as a Tier 1 – Airport Reference Code (ARC) C-III facility. Classification as a Tier I facility means the Airport is essential and critical to meet state airport system goals and it should be developed to its full and appropriate level to meet projected need. An ARC classification of C-III means the Airport is designed to serve aircraft at approach speeds equal to or less than 140 knots and/or can serve aircraft with wingspans up to 118 feet in length. See **Table 2-1** for more information on ARC classifications.

2.1.c National Plan of Integrated Airport Systems (NPIAS) Role – The National Plan of Integrated Airport Systems (NPIAS) identifies airports that are significant to the national air transportation system. Airports included in the NPIAS are eligible to receive federal grant money under the Airport Improvement Plan (AIP), and are considered necessary in order to provide a safe, efficient, and integrated national airport system. The Airport is classified in the NPIAS as a primary, non-hub, commercial service facility. The Airport is classified as "primary" because more than 10,000 passengers are enplaned annually, "commercial service" because scheduled commercial service is offered and at least 2,500 passengers are enplaned annually, and "non-hub" because the Airport enplanes less than 0.05 percent (0.05%) of the national enplanement annual total. These classifications and inclusion in the NPIAS demonstrates its importance not only to the region and the State of Michigan, but also to the national air transportation system.

2.1.d Part 139 Role – Since the Airport is certified under Title 14 Code of Federal Regulations (CFR) Part 139, *Certification of Airports*, it is subject to certification by the FAA for compliance with regulatory safety standards. Under CFR Part 139, the Airport is designated a Class I that can serve scheduled operations of small and large air carrier aircraft as well as large unscheduled air carrier aircraft. Class I Part 139 airports are subject to compliance with all parts of the regulation to maintain safety for airport users.

As the sole provider of commercial air service to the southwest Michigan region, it is important to understand the Airport's market area. The central location of the Airport in the region allows it to attract passengers as far north as Grand Rapids, as far south as the Indiana border, and as far east as Jackson. However for forecasting purposes, the geographic areas of Kalamazoo, Calhoun, and Van Buren counties will be used in representing the primary service area of the Airport. **Figure 2-1** illustrates the service area of the Airport.

Figure 2-1
Airport Service Area



Source: Map generated using the United States Geological Service *National Map* Viewer

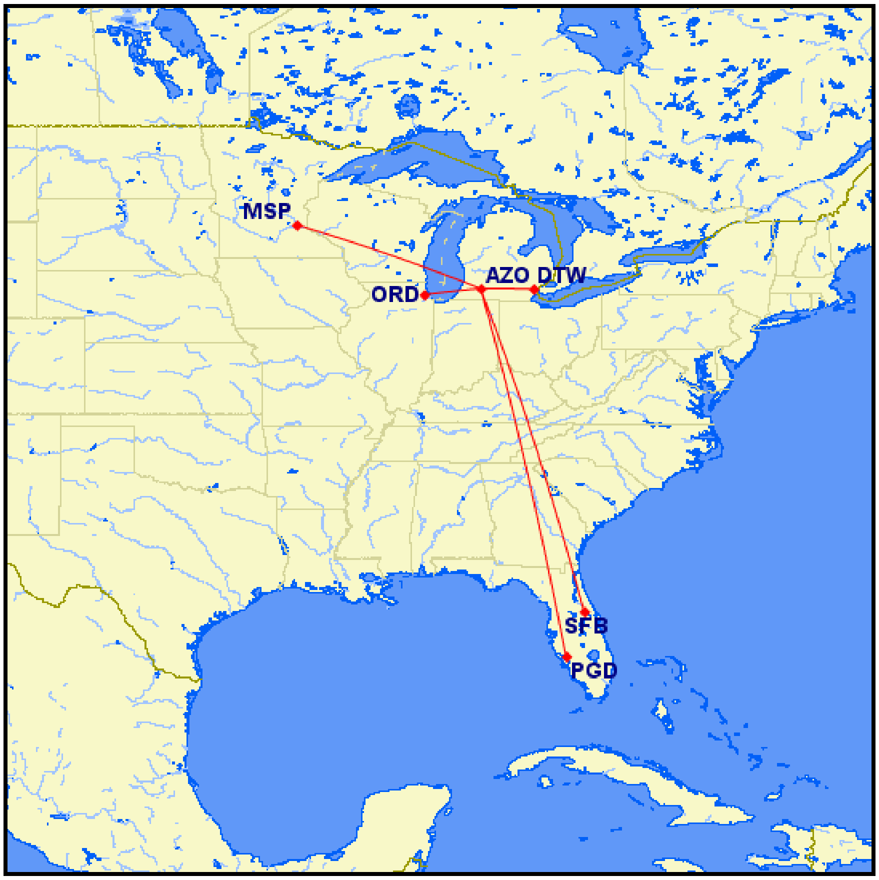
As of July 2011, three airlines provide commercial passenger service at the Airport. Delta Air Lines is the primary airline, providing seven daily departures to Detroit, and two daily departures to Minneapolis. American Eagle, a subsidiary of American Airlines, operates five departures daily to Chicago-O'Hare. Direct Air operates as a scheduled public charter and offers five flights a week to Orlando-Sanford, Florida and two flights a week to Ft. Myers/Punta Gorda, Florida. **Figure 2-2** illustrates the air service routes from the Airport.

2.2 Industry Trends

Understanding existing and anticipated industry trends is important when forecasting future aviation activity at an airport. An assessment of these trends allows an airport to achieve a greater understanding of future activity and helps an airport plan for future needs. To assist airports, the FAA releases their annual forecasting report *FAA Aerospace Forecast* that analyzes anticipated aviation activity across the United States. The latest edition of the forecast (for fiscal years 2010-2030) reviews existing and future industry trends, and is utilized in the following sections.

2.2.a World/National Economy – Before reviewing aviation industry trends, it is important to first understand national and global economic trends. In 2009, the economy of the nation and the world continued to decline overall as a result of the economic downturn that occurred in 2008. Only a modest economic rebound occurred towards the end of the year. As of early 2010, the United States (U.S.) and global economies showed slight gains, illustrating a slow recovery from the 2008 downturn. Low to modest economic growth is projected for the U.S. and other global economies through 2010, with a larger growth forecasted to begin in 2011.

Figure 2-2
Commercial Airline Service Routes



Map generated by the Great Circle Mapper - copyright © Karl L. Swartz.

2.2.b Commercial Aviation – The *2010-2030 FAA Aerospace Forecast* report downgraded its growth projects from previous year's forecasts as a result of the sharp economic downturn that occurred in 2008. Domestic mainline carriers will continue to cut capacity and are forecasted to decline 1.6 percent (1.6%) in 2010. Regional carriers, on the other hand, are anticipated to grow 1.9 percent (1.9%) in 2010 which is indicative of the trend in commercial aviation where air carriers are reducing mainline aircraft in favor of smaller 70-90 seat regional jet aircraft.

Domestic passenger enplanements, which experienced a 7.3 percent (7.3%) decline in 2009, are anticipated to increase 0.4 percent (0.4%) in 2010. Regional carrier growth is projected at 3.0 percent (3.0%) a year through 2030 while mainline carriers are anticipated to grow only 2.2 percent (2.2%) a year. This is also illustrative of a changing trend for using smaller regional jet aircraft instead of larger mainline aircraft.

Overall, the slow return to growth forecasted in the commercial aviation industry and the increasing regional jet use are important points to consider when planning for future aviation development. Though short term trends and forecasts predict slow to no growth, this time period allows the Airport an opportunity to plan for future development to meet increased user needs when growth returns.

2.2.c Business Aviation – The economic downturn of 2008 greatly impacted business aviation nationwide. Companies across the country minimized their use of business aircraft as they looked for ways to decrease spending. Though this sharp decrease occurred, the demand for business jet aircraft has continued to grow over the past several years. Introduction of new jet aircraft, increasing foreign competition, and new product offerings have contributed to this increase. These factors, along with increasing commercial airline flight delays, personal safety/security concerns for business staff, and the need for on-demand business related travel has allowed business aviation to grow since 2008.

Despite the sharp decline in 2008, business aviation is anticipated to grow over the long term at a faster rate than personal/recreational GA aircraft. Recent industry trends forecast an increase in the use of smaller, four to eight passenger jet aircraft, along with more fuel efficient long-range business jets. It is important that the Airport plan accordingly to accommodate these types of business aircraft, and promote economic growth in the region.

2.2.d General Aviation – Personal/recreational general aviation suffered the greatest decrease in any sector as a result of the 2008 economic downturn. Since this form of aviation is generally associated with discretionary spending, it is more susceptible to the reduction or loss of personal incomes. Overall, the 2010-2030 *FAA Aerospace Forecast* projects the active GA fleet to increase at a rate of 0.9 percent (0.9%) each year through 2030, growing from an estimated 229,149 aircraft in 2009 to 278,723 aircraft in 2030.

Piston-powered aircraft in the U.S. active fleet are projected to decline through 2017, at which time growth is anticipated to occur again. One reason for the projected decrease in single-engine piston-powered aircraft is the growth in a new category of aircraft titled “light sport”. Light sport aircraft are also single piston-powered engine aircraft with regulations on takeoff weight and stall speed based on intended operation over water. These aircraft have limited cruise and stall speeds, are equipped with a fixed undercarriage, and can seat up to two people. This category of aircraft is intended to allow recreational pilots a less costly opportunity to fly without meeting full pilot licensing guidelines or aircraft maintenance specifications needed for traditional single piston-powered engine aircraft. Light sport aircraft are forecasted to add 825 aircraft to the GA fleet through 2013, at which time growth is anticipated to taper to 335 aircraft a year through 2030.

Since the Airport offers a variety of services for general aviation and has a number of based GA aircraft, it is important that future planning at the Airport accommodate this segment of aviation. As light sport aircraft become more popular, the Airport will need to adequately plan for future GA development to meet user needs. In the forecasts presented later in this Chapter, light sport aircraft are included in the GA projections as single-engine aircraft.

2.2.e Cargo Aviation – Cargo aviation also experienced a sharp decline in operations in 2008 as a result of the economic downturn. In 2009, the air cargo industry experienced a 17.7 percent (17.7%) decrease in domestic revenue ton miles (RTMs) and a 23 percent (23.0%) decrease in international RTMs from 2008. Along with economic downturn of the U.S. and global economies, this decrease can also be attributed to price competition from other transportation modes.

Since cargo aviation has historically been tied to gross domestic product (GDP), a growth in the national and global economies is anticipated to contribute to the growth of cargo aviation. The 2010-2030 *FAA Aerospace Forecast* projects domestic RTMs to experience low growth through 2011, and then increase at an annual rate of 2.2 percent (2.2%) through 2030. International RTMs are projected to rise 4.7 percent (4.7%) in 2010, increase to 6.6 percent (6.6%) in 2011, and then increase through 2030 annually at 6.3 percent (6.3%).

Though no dedicated air cargo facilities are currently located at the Airport, it is important to monitor industry trends in this segment of aviation for a couple of reasons. First, while no regularly scheduled operations of large cargo aircraft occur, occasional operations from narrow-bodied jets and daily operations from smaller single- and twin-engine piston-powered cargo aircraft do occur at the Airport. Secondly, air cargo is transported in the cargo holds of commercial air service aircraft which operate at the Airport. Therefore, it is important for the Airport to continually monitor this segment of aviation in order to provide facilities that meet the existing and future air cargo needs of southwest Michigan.

2.3 Critical Aircraft

In addition to understanding trends within the industry, it is also important to understand the significance of critical design aircraft when developing forecasts. Critical aircraft are defined as the most demanding type of aircraft anticipated to regularly operate at an airport, and typically performs at least 500 annual operations. This section will review the critical design aircraft for four different segments of aviation.

2.3.a Airport Reference Code (ARC) – In determining the critical design aircraft, the FAA defines aircraft types based on the ARC. The ARC is an aircraft coding system that assigns a letter for categories of aircraft approach speeds found in the Aircraft Approach Category (AAC) and a Roman numeral based on wingspans found in the Airplane Design Group (ADG). Further explanation of the ARC is explained in Chapter 3, Demand Capacity and Facility Requirements. **Table 2-1** illustrates the categories within the ARC coding system.

Table 2-1
Airport Reference Code

Aircraft Approach Category (AAC)	
Category A	Aircraft approach speed less than 91 knots
Category B	Aircraft approach speed 91 knots or greater but less than 121 knots
Category C	Aircraft approach speed 121 knots or greater but less than 141 knots
Category D	Aircraft approach speed 141 knots or greater but less than 166 knots
Category E	Aircraft approach speed 166 knots or more
Airplane Design Group (ADG)	
Group I	Wingspan less than 49 feet
Group II	Wingspan 49 feet or greater but less than 79 feet
Group III	Wingspan 79 feet or greater but less than 118 feet
Group IV	Wingspan 118 feet or greater but less than 171 feet
Group V	Wingspan 171 feet or greater but less than 214 feet
Group VI	Wingspan greater than 214 feet

Source: FAA AC 150/5300, *Airport Design*

2.3.b Commercial Aircraft – The Airport has an ARC designation of C-III, meaning it is designed for aircraft with approach speeds up to 141 knots, and wingspans up to 118 feet. Examples of category C-III commercial aircraft include the DC-9, Boeing 737, Airbus A320, and the Canadair Regional Jet (CRJ). These aircraft types are commonly found in the fleets of the airlines that operate at the Airport. Incoming 70 to 90 seat regional jet aircraft including the Embraer ERJ-170/190 and the CRJ-900 are also categorized as C-III aircraft.

2.3.c Business Aircraft – Most business aviation aircraft are categorized in ARC groups B-I through C-II, with a few of the largest models in ARC groups C-III and D-III. Though designed for C-III aircraft, the Airport is capable of accommodating occasional operations by larger ARC category aircraft. Aircraft Approach Category D aircraft which have been known to conduct operations at the Airport include the Gulfstream G-II, G-IV, G-V, Lear 35, 45, and 60; however these operations by these aircraft types are not anticipated to total more than 500 annually.

ARC C-III aircraft which operate occasionally at the Airport include the Bombardier Global Express and the Boeing Business Jet (BBJ) jet aircraft. Other business jet aircraft in lesser ARC categories that operate at the Airport include C-II category Gulfstream G-IIIs, B-II category Falcon 2000s and Cessna Citations (C550, C560, C650 CJ1, CJ3) and category C-I and D-I Learjets (24,25,35,45,55,60). Many twin piston-engine business aircraft such as B-I category Beechcraft King Air and the Cessna 421 aircraft also regularly operate at the Airport.

2.3.d General Aviation Aircraft – Most GA aircraft operated for personal and recreational use are classified in ARC category A-I. These types of aircraft are commonly found and based at the Airport and include the Cessna 172, Beech Bonanza, Cirrus SR22, and Piper PA-28. Light sport aircraft are being added to the GA fleet mix and are also categorized as A-I aircraft. Examples of light sport A-I category aircraft include new aircraft types such as the Cessna 162 and the AMD Zodiac and existing types such as the Piper J-3 and the Aeronca 7AC.

2.3.e Cargo Aircraft – Cargo aircraft can range from small, single-engine aircraft to multi jet engine freighters. Although large cargo aircraft do not operate at the Airport on a regularly scheduled basis, types ranging up to ARC category C-III (such as the DC-9 freighter) do conduct unscheduled operations. Smaller single- and twin-engine cargo aircraft such as the ARC category B-I Cessna Caravan and Swearingen Metroliner aircraft operate on a daily basis at the Airport.

Overall, the Airport's critical design aircraft ARC C-III narrow body commercial jet (such as the Boeing 737 or the Airbus A320), is not anticipated to change throughout the planning period.

2.4 Forecasting Approach

It is critical when developing aviation forecasts to understand the various forecasting methodologies which can be used. A number of FAA recommended forecasting techniques exist that utilize mathematical formulas to derive future aviation activity. Using mathematical formulas, data that utilizes historical patterns can be applied to produce a line or curve that can be used to project future growth. Using the best judgment in analyzing these forecast models is to determine what methodology provides the most realistic approach to forecasting future aviation activity. The following sections explain the methodologies that were used to develop the projections presented later in this Chapter:

2.4.a FAA TAF Summary – The Terminal Area Forecast (TAF) is the official forecast of aviation activity by the FAA for individual airport sites. Along with providing projections of future aviation demand, the TAF is also utilized to meet budget and planning needs within the FAA. The TAF is also utilized by state, regional, and local authorities, the aviation industry, and the public for aviation planning purposes. Along with providing aviation activity at towered airports, the TAF also projects activity at non-towered public use airports since finding accurate statistical data on based aircraft and the number of annual operations is often a challenge. Detailed forecasts are provided for large air carrier and busy GA airports within the national aviation system. To account for industry trends and changes affecting the industry, the FAA TAF is updated on an annual basis.

2.4.b Time-series Methodologies – Historical trend lines and linear extrapolation are widely used forecasting methods. These techniques utilize time-series data and are most useful for a pattern of demand that demonstrates a historical relationship with time. Linear extrapolation establishes a linear trend by fitting a straight line using the least squares method to known historical data. Also used in this Chapter are growth rate trend analyses which examine historical compounded annual growth rates (CAGRs) and extrapolate future data values by assuming a similar compounded annual growth rate for the future.

2.4.c Market Share Methodology – Market share, ratio, or top-down models compare local levels of activity with a larger entity. Such methodologies imply that the proportion of activity that can be assigned to the local level is a regular and predictable quantity. This method has been used extensively in the aviation industry to develop forecasts at the local level. It is most commonly used to determine the share of total national traffic activity that will be captured by a particular region or airport. Historical data is examined to determine the ratio of local airport traffic to total national traffic. The FAA develops national forecasts annually in its FAA Aerospace Forecasts document. This data source is compared with historical levels of activity reported by the Airport.

2.4.d Socio-Economic Methodologies – Though trend line extrapolation and market share analysis may provide mathematical and formulaic justification for demand projections, there are many factors beyond historical levels of activity that may identify trends in aviation and have an impact on aviation demand locally. Socio-economic, or correlation, analysis examines the direct relationship between two or more sets of historical data. Local conditions that are examined in this Chapter include population and per capita income within Calhoun, Kalamazoo, and Van Buren Counties.

Projections of aviation demand presented in this report are based on five year increments beginning with 2015 and ending in 2030. 2009 has been used as the base year for these forecasts as it was the most recent year that a full 12 months of data was available. Since these forecasts were conducted in 2010, 2011 has been left out of the forecasts to avoid confusion between partial historical and projected data that was available at the time this plan was developed.

2.5 Passenger Enplanement Projections

Enplanements are defined as the activity of passengers boarding commercial service aircraft that depart an airport. Enplanements include passengers on scheduled commercial service aircraft or non-scheduled charter aircraft and do not include the airline crew.

Passenger enplanement data is provided to Airport management by commercial air service carriers, who maintain data as they transport people to and from the facility. The FAA has estimated figures on file within the Terminal Area Forecasts (TAF); however Airport records are generally a more accurate source. It should also be noted that the TAF presents annual data for a fiscal year, while Airport records are for the calendar year. This is one reason there is often a discrepancy between reported annual totals. Historical data provided by the Airport is used for projections presented in this Chapter,

In reviewing historical enplanement data, a general decline in passenger enplanements has been the trend since enplanements peaked in 1998. Since 1998, a 50.5 percent (50.5%) decline in enplanements has occurred from 282,348 in 1998 to 139,712 in 2009. This decline can be attributed to several factors including airline mergers, airlines cutting flight frequency and/or dropping service to the Airport, and the downturn in the aviation industry following the terrorist attacks of September 11, 2001. Downturn in the economic climate of the past few years also has contributed to the decline.

Though passenger enplanements have been on the general decline since 1998, it is anticipated that 2009 was the bottom and that enplanements in 2010 will exhibit an increase over 2009 levels. Current airline schedules indicate that the number seats serving the market are anticipated to increase in 2010. American Airlines has added frequency to Chicago-O'Hare, and Delta has added frequency to the Detroit Metropolitan Wayne County International Airport which offsets their decrease in frequency to Minneapolis, Minnesota. Scheduled departing seats in 2009 totaled 217,126 and current airline schedules show 235,123 scheduled for 2010, resulting in an anticipated increase of 8.3 percent (8.3%). **Table 2-2** summarizes the scheduled departing seats in 2009 and those currently scheduled for 2010 (as of April 2010).

2.5.a Time-series Methodologies – Time-series or trend line projections are based upon the primary assumption that future trends will continue to mimic those in a selected time period and that the factors which affect those trends will continue to influence demand levels in a similar fashion. Based on the general decline in historical enplanements since 1998 at the Airport, the linear trend line and growth rate methodologies project a decrease in passenger enplanements through 2030, with negative 2.72 percent (-2.72%) and negative 3.02 percent (-3.02%) declines in CAGR, respectively. However as noted above, the scheduled air service capacity situation at the Airport is stabilized for 2010, and airline schedules actually show an increase in capacity in 2010. **Table 2-3** summarizes the time-series enplanement projection methodologies.

Table 2-2
Scheduled Seats

	2009						2010					
Carrier	AA	D1	DL	NW	NW		AA	D1	DL	DL	DL	
Dest	ORD	SFB	CVG	DTW	MSP	**Total**	ORD	SFB	CVG	DTW	MSP	**Total**
Jan	5,818		350	9,886	1,550	17,604	6,642	1,359		8,678	1,550	18,229
Feb	5,206			9,052	1,400	15,658	6,052	1,208		9,028	1,400	17,688
Mar	5,862			9,932	1,550	17,344	6,792	1,359		11,144	1,550	20,845
Apr	6,700			9,672	1,500	17,872	6,584	1,359		10,672	1,500	20,115
May	7,050			9,954	1,680	18,684	6,942	1,359		9,810	1,550	19,661
Jun	6,842	755		8,476	2,676	18,749	6,652	1,208		9,800	1,500	19,160
Jul	6,888	1,359		10,932	2,900	22,079	6,786	1,359		9,920	1,550	19,615
Aug	6,944	1,359		9,520	2,250	20,073	6,830	1,359		10,366	1,550	20,105
Sep	6,688	1,208		7,721	1,500	17,117	6,604	1,208		10,240	1,500	19,552
Oct	6,932	1,359		7,930	1,550	17,771	6,786	1,359		10,408	1,550	20,103
Nov	6,554	1,359		7,576	1,450	16,939	6,604	1,359		10,240	1,500	19,703
Dec	6,516	1,208		7,962	1,550	17,236	6,830	1,359		10,608	1,550	20,347
Total	78,000	8,607	350	108,613	21,556	217,126	80,104	15,855		120,914	18,250	235,123
Change (2009 to 2010)							*2,104*	*7,248*	*(350)*	*12,301*	*(3,306)*	*17,997*
Percent Change (2009-2010)							*2.7%*	*84.2%*		*11.3%*	*-15.3%*	*8.3%*

Source: Mead & Hunt

Table 2-3
Time-series Enplanement Projections

	Trend Line	Growth Rate	
Year	**Enplanements**	**Enplanements**	**Growth Rate**
Historical:			
1990	250,048	250,048	
1995	257,039	257,039	-4.14%
2000	258,118	258,118	-7.52%
2001	229,801	229,801	-10.97%
2002	234,796	234,796	2.17%
2003	223,244	223,244	-4.92%
2004	222,343	222,343	-0.40%
2005	236,744	236,744	6.48%
2006	206,659	206,659	-12.71%
2007	191,408	191,408	-7.38%
2008	166,986	166,986	-12.76%
2009	139,712	139,712	-16.33%
		CAGR (1990-2009)	*-3.02%*
Projected:			
2015	157,259	116,253	*-3.02%*
2020	130,957	99,743	*-3.02%*
2025	104,655	85,577	*-3.02%*
2030	78,353	73,423	*-3.02%*
CAGR 2009-2030	*-2.72%*	*-3.02%*	

Notes: CAGR = Compounded Annual Growth Rate
Sources: Historical Enplanements - Airport Records
Projections - Mead & Hunt

2.5.b Market Share Methodologies – Over the past ten years, the Airport's passenger enplanement market share has declined (see **Table 2-4**), as a result of the changes and reductions in air service at the Airport. Since 2000, the highest market share for the Airport was experienced in 2002 at .0408 percent (.0408%), and the lowest market share of 0.0221 percent (0.0221%) was experienced in 2009.

Two distinct market share scenarios were prepared. The first assumes that market share will decrease only slightly to 0.02 percent (0.02%) and remain steady at this level through the projection period. The second assumes that the Airport's market share will slowly increase through the projection period back to its average from 2000 to 2009. Utilizing forecasts from the FAA on total U.S. domestic enplanements, 209,100 passenger enplanements are projected at the Airport in 2030 using the first market share scenario, resulting in a CAGR of 1.94 percent (1.94%). This is slightly below the FAA's projected growth rate of 2.43 percent (2.43%) in U.S. domestic enplanements. The second market share scenario projects 346,916 enplanements in 2030, resulting in a CAGR of 4.43 percent (4.43%).

Table 2-4
Market Share Enplanement Projections

	Market Share Methodology 1			Market Share Methodology 2		
Year	Enplanements	Total U.S. Domestic Enpl (mil)	Market Share	Enplanements	Total U.S. Domestic Enpl (mil)	Market Share
Historical:						
2000	258,118	641.2	0.0403%	258,118	641.2	0.0403%
2001	229,801	625.8	0.0367%	229,801	625.8	0.0367%
2002	234,796	575.1	0.0408%	234,796	575.1	0.0408%
2003	223,244	587.8	0.0380%	223,244	587.8	0.0380%
2004	222,343	628.5	0.0354%	222,343	628.5	0.0354%
2005	236,744	669.5	0.0354%	236,744	669.5	0.0354%
2006	206,659	668.4	0.0309%	206,659	668.4	0.0309%
2007	191,408	690.1	0.0277%	191,408	690.1	0.0277%
2008	166,986	681.3	0.0245%	166,986	681.3	0.0245%
2009	139,712	631.3	0.0221%	139,712	631.3	0.0221%
		Average (2000-2009)	*0.0332%*		*Average (2000-2009)*	*0.0332%*
Projected:						
2015	144,623	723.1	0.0200%	182,861	723.1	0.0253%
2020	164,286	821.4	0.0200%	229,337	821.4	0.0279%
2025	185,862	929.3	0.0200%	283,909	929.3	0.0306%
2030	209,100	1,045.5	0.0200%	346,916	1,045.5	0.0332%
CAGR 2009-2030	*1.94%*	*2.43%*		*4.43%*	*2.43%*	

Notes: CAGR = Compounded Annual Growth Rate
Sources: Historical Enplanements - Airport Records
FAA Aerospace Forecasts
Projections - Mead & Hunt

2.5.c Socio-economic Methodologies – Socio-economic factors that occur locally can impact levels of passenger activity. This Master Plan Update presents projections of population and per capita income to forecast enplanements. Historical levels and projections of population and per capita income were obtained from Woods & Poole, Inc., a firm that specializes in the development of local socio-economic projections.

Local economic conditions can impact levels of passenger activity. Local population levels can also impact the number of airline passengers and it is assumed that one's propensity toward air travel can be partially linked to available income. Population is projected to increase at a CAGR of 0.41 percent (0.41%) through 2030 along with per capita income at a CAGR of 1.09 percent (1.09%).

Enplanements per capita and per one dollar ($1) of per capita income have declined since 2000, commensurate with the decline in air service capacity through this period. It is anticipated that significant declines in air service capacity has ceased, and projections of 2009 levels of enplanements per capita and per one dollar ($1) of capita income will be maintained. Therefore, enplanements are projected to increase at the same CAGR as population and per capita income at 0.41 percent (0.41%) and 1.09 percent (1.09%), respectively. **Table 2-5** summarizes the results of these enplanement projection methodologies.

Table 2-5
Socio-economic Enplanement Projections

	Socio-Economic Methodology - Population Variable			Socio-Economic Methodology - Income Variable		
Year	Enplanements	Calhoun, Kalamazoo, VanBuren Counties Population	Enplanements Per Capita	Enplanements	Calhoun, Kalamazoo, VanBuren Counties Per Capita Income (2004$)	Enplanements Per $1 Income
Historical:						
2000	258,118	458,713	0.563	258,118	$28,936	8.920
2001	229,801	458,517	0.501	229,801	$28,649	8.021
2002	234,796	458,628	0.512	234,796	$28,705	8.179
2003	223,244	458,674	0.487	223,244	$29,362	7.603
2004	222,343	459,574	0.484	222,343	$29,164	7.624
2005	236,744	461,671	0.513	236,744	$29,071	8.144
2006	206,659	463,804	0.446	206,659	$29,384	7.033
2007	191,408	465,933	0.411	191,408	$29,744	6.435
2008	166,986	468,123	0.357	166,986	$30,114	5.545
2009	139,712	470,354	0.297	139,712	$30,495	4.582
		Average (2000-2009)	*0.502*		*Average (2000-2009)*	*8.008*
Projected:						
2015	141,078	474,952	0.297	143,304	$31,279	4.582
2020	144,643	486,956	0.297	152,950	$33,384	4.582
2025	148,345	499,417	0.297	163,630	$35,715	4.582
2030	152,094	512,038	0.297	175,448	$38,295	4.582
CAGR 2009-2030	*0.41%*	*0.41%*		*1.09%*	*1.09%*	

Notes: CAGR = Compounded Annual Growth Rate
Sources: Historical Enplanements - Airport Records
Historical & Projected Population & Per Capita Income - Woods & Poole Economics, Inc.
Projections - Mead & Hunt

2.5.d Federal Aviation Administration Enplanement Forecast – Reviewing the FAA TAF forecasts, a 1.31 percent (1.31%) CAGR in passenger enplanements occurs over the forecast period from 160,159 enplanements in 2015 to 183,707 enplanements in 2030. The FAA TAF for the Airport is presented in **Table 2-6**. Note that the historical FAA TAF data is for the federal fiscal year, rather than the calendar year, hence the slight differences in the historical data. Also, the TAF data for 2009 was estimated and not based on actual enplanement counts.

Forecasts that are developed for airport master plans and/or federal grants must be approved by the FAA. It is the FAA's policy, listed in Advisory Circular 150/5070-6B, *Airport Master Plans*, that FAA approval of forecasts at non-hub airports with commercial service should be consistent with the TAF. Master plan forecasts for operations, based aircraft, and enplanements are considered to be consistent with the TAF if they meet the following criteria:

- Forecasts differ by less than 10 percent in the five-year forecast and 15 percent in the 10-year or 20-year period, or
- Forecasts do not affect the timing or scale of an airport project, or
- Forecasts do not affect the role of the airport as defined in the current version of FAA Order 5090.3, Field Formulation of the National Plan of Integrated Airport Systems.

Table 2-6
FAA Terminal Area Forecast Enplanement Projections

Year	Historical Enplanements	FAA TAF Enplanements
Historical:		
2000	258,118	265,419
2001	229,801	244,263
2002	234,796	253,617
2003	223,244	225,985
2004	222,343	218,446
2005	236,744	238,840
2006	206,659	210,950
2007	191,408	193,301
2008	166,986	172,283
2009	139,712	151,681
Projected:		
2015		160,159
2020		167,621
2025		175,465
2030		183,707
CAGR 2009-2030		*1.31%*

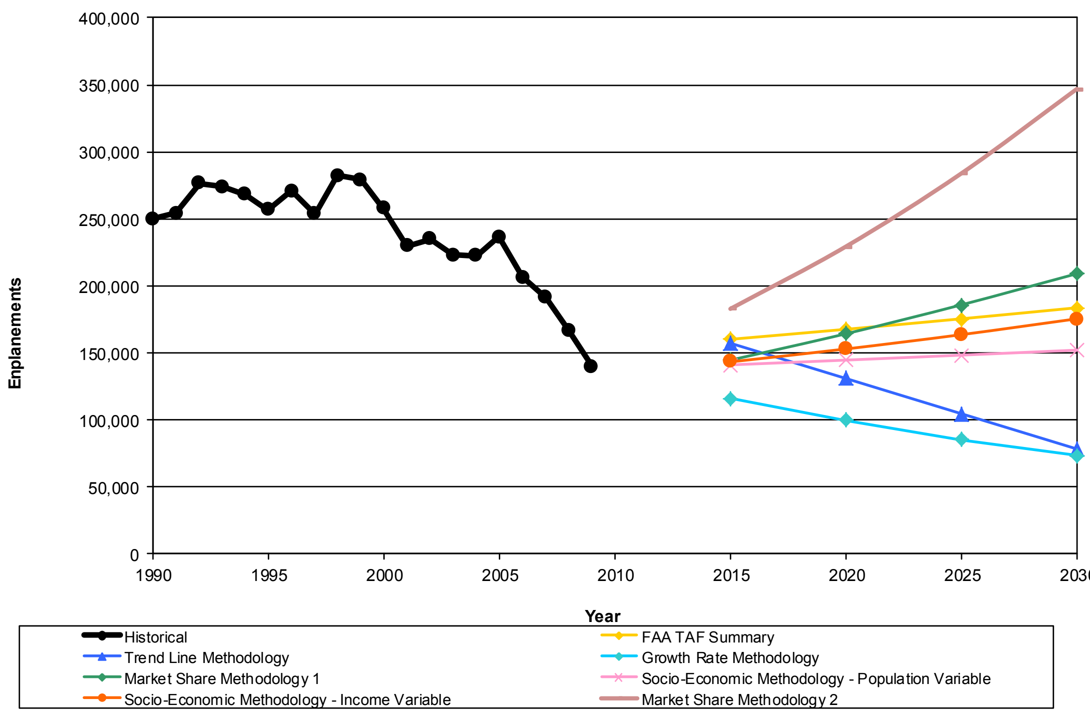
Notes: CAGR = Compounded Annual Growth Rate
Sources: Historical Enplanements – Airport Records
FAA Terminal Area Forecast

2.5.e Passenger Enplanement Comparison – A comparison of the passenger enplanement projections described in this Chapter are depicted in **Table 2-7**.

Though recent trends illustrate a decline in passenger enplanements, a gradual increase in Airport enplanements is projected, keeping in trend with national enplanement projections. Therefore, the Market Share Methodology 1 is the preferred enplanement forecast for the purposes of this Master Plan Update and for long-range planning. This methodology lies within the range of the other forecasts, takes into account the FAA's national projections in respect to slowly increasing passenger enplanements, and lies within 15 percent (15%) of the FAA's TAF 20-year forecast, meeting TAF consistency requirements. This methodology projects enplanements to increase to 144,623 in 2015, then increase at a CAGR of 1.94 percent (1.94%) throughout the forecast period projecting 209,100 enplanements in 2030.

Table 2-7
Passenger Enplanement Projections Comparison

Year	Historical	FAA TAF Summary	Trend Line Methodology	Growth Rate Methodology	*Preferred* Market Share Methodology 1	Market Share Methodology 2	Socio-Economic Methodology - Population Variable	Socio-Economic Methodology - Income Variable
Historical:								
1990	250,048							
1991	254,198							
1992	276,553							
1993	273,959							
1994	268,146							
1995	257,039							
1996	271,087							
1997	253,600							
1998	282,348							
1999	279,108							
2000	258,118							
2001	229,801							
2002	234,796							
2003	223,244							
2004	222,343							
2005	236,744							
2006	206,659							
2007	191,408							
2008	166,986							
2009	139,712							
CAGR 1995-2009	*-3.02%*							
Projected:								
2015		160,159	157,259	116,253	144,623	182,861	141,078	143,304
2020		167,621	130,957	99,743	164,286	229,337	144,643	152,950
2025		175,465	104,655	85,577	185,862	283,909	148,345	163,630
2030		183,707	78,353	73,423	209,100	346,916	152,094	175,448
CAGR 2009-2030		*1.31%*	*-2.72%*	*-3.02%*	*1.94%*	*4.43%*	*0.41%*	*1.09%*



Notes: CAGR = Compounded annual growth rate.
Sources: Historical Enplanements - Airport Records
Projections - Mead & Hunt, Inc., except FAA TAF Summary which are from the FAA Terminal Area Forecast

Market Share Methodology 2 has been selected to serve as a high growth, sensitivity analysis scenario. Future potential in the Airport's market share could increase levels towards its historical average, bringing enplanements back closer to their 1990 to 2000 average, with levels slightly above as national enplanement levels are projected to continue to increase. This high growth scenario would also allow the Airport to review long-term facility needs should this growth occur, and have a more flexible long-term plan that is able to accommodate a number of different demand scenarios. Facilities are typically not recommended for construction until a projected demand materializes so no negative repercussions are anticipated with utilizing this additional scenario as appropriate within the facility requirements section of this document.

2.6 Commercial Air Carrier Operations and Fleet Mix Projections

Forecasting the number of commercial operations is a useful tool in helping gauge future demand of the airfield infrastructure. Review of these forecasts can assist an airport in planning for terminal and airfield infrastructure development.

2.6.a Scheduled Airline Operations – Historical scheduled airline operations data obtained from Airport records and OAG Aviation is presented in **Table 2-8**. Similar to enplanements, historical counts of scheduled passenger operations has also been declining from 8,035 scheduled passenger departures in 2004 to 4,326 in 2009. This is a result of several factors, including a reduction in airline service, airline mergers, increasing air carrier load factors (percentage of available seats sold/occupied), and the economy.

The FAA projects that the U.S. regional carrier fleet will increase from an average aircraft size of 55 seats in 2009, to 65.4 seats in 2030. Increased usage of 70-90 seat passenger aircraft attributes to the increased average seats per departure at the Airport.

Additionally, airline business models are changing to reflect higher load factors throughout the industry as airlines look to regain and maintain profitability. The FAA projects that the nationwide load factor for the U.S. regional carrier fleet will increase from 74.3 percent (74.3%) in 2009 to 77.3 percent (77.3%) in 2030. It is projected that the Airport's load factor will increase through the planning period, bringing it closer in line with the national average.

Projections of scheduled departures were calculated from the preferred passenger enplanement methodology and the average number of seats and load factors were applied to determine the number of departures. Overall, the increases in seats on regional aircraft and load factors result in a modest CAGR of 0.18 percent (0.18%) for the projected number of scheduled air carrier departures and operations from 2009 to 2030.

Table 2-8
Scheduled Passenger Operations Projections

Year	Enplanements	Scheduled Passenger Departures	Average Seats/Dep	Load Factor	Schedule Passenger Operations
Historical:					
2004	222,343	8,035	52.7	52.5%	16,070
2005	236,744	7,951	54.2	54.9%	15,902
2006	206,659	6,825	52.4	57.7%	13,650
2007	191,408	6,383	50.6	59.2%	12,766
2008	166,986	5,678	52.8	55.7%	11,356
2009	139,712	4,326	50.2	64.3%	8,652
Projected:					
2015	144,623	3,984	55.0	66.0%	7,968
2020	164,286	4,165	58.0	68.0%	8,331
2025	185,862	4,425	60.0	70.0%	8,851
2030	209,100	4,497	62.0	75.0%	8,994
CAGR 2009-2030	*1.94%*	*0.18%*			*0.18%*

Notes: CAGR = Compouned annual growth rate
Sources: Historical Enplanements - Airport Records
Historical Scheduled Air Carrier Departures and Average Seat Data - OAG Airline Schedules
Projections - Mead & Hunt, Inc.

Notes: CAGR – Compounded Annual Growth Rate
Sources: Historical Enplanements – Airport Records
Historical Scheduled Air Carrier Departures and Average Seat Data – OAG Airline Schedules
Projections – Mead & Hunt, Inc.

2.6.b Scheduled Airline Fleet Mix – To project future air carrier operations, the type and capacity of aircraft that will operate at the Airport must be determined. For the purposes of this Master Plan Update, passenger aircraft have been grouped into five categories based on the number and configuration of seats.

Due to changes in operational costs and consumer travel behavior, airlines are faced with critical decisions to maximize fleet efficiency and remain sustainable. As previously mentioned, national trends and industry outlooks indicate that a number of air carriers operating out of markets like Kalamazoo are utilizing regional airlines. The fleets of these regional airlines are being filled with larger 70 to 90 seat jets that have more seats than traditional 50 seat jets and 20 to 34 seat turboprop regional aircraft. These 70 to 90 seat aircraft have lower operational costs per passenger, making them increasingly popular with regional airlines.

Projections of seats per departure and typical aircraft are presented in **Table 2-9**. Based on historical data and assumptions on local and national trends, aircraft that seat between 40 and 60 passengers will continue to make up the majority of the operations, however, the number of 61 to 100 seat regional jets serving the Airport is projected to increase. The average number of seats per departure is projected to increase from 50.19 in 2009 to 62 in 2030.

Table 2-9

Scheduled Airline Fleet Mix Projections

Seat Range	Typical Aircraft	Historical 2006	2007	2008	2009	Projected 2015	2020	2025	2030
Less than 40	Saab340, 328Jet, ERJ135	776	1,256	819	571	0	0	0	0
		11.4%	*19.7%*	*14.4%*	*13.2%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
40-60	CRJ200, ERJ145	5,325	4,570	4,202	3,417	3,506	3,207	3,098	2,923
		78.0%	*71.6%*	*74.0%*	*79.0%*	*88.0%*	*77.0%*	*70.0%*	*65.0%*
61-99	AvroRJ, CRJ700, CRJ900, EMB170	119	1	248	280	319	791	1,106	1,349
		1.7%	*0.0%*	*4.4%*	*6.5%*	*8.0%*	*19.0%*	*25.0%*	*30.0%*
100-130	B717, DC9, EMB190, EMB195	605	556	409	1	80	83	133	135
		8.9%	*8.7%*	*7.2%*	*0.0%*	*2.0%*	*2.0%*	*3.0%*	*3.0%*
131 or more	A319, A320, MD80, B737	0	0	0	57	80	83	89	90
		0.0%	*0.0%*	*0.0%*	*1.3%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*
						100.0%	*100.0%*	*100.0%*	*100.0%*
Total Scheduled Passenger Aircraft Departures		6,825	6,383	5,678	4,326	3,984	4,165	4,425	4,497
Average Seats Per Departure		52.44	50.64	52.81	50.19	55.0	58.0	60.0	62.0
Total Scheduled Seats		357,932	323,239	299,829	217,126	219,126	241,597	265,517	278,799

Sources: Historical Scheduled Departures and Average Seat Data - APGData
Projections - Mead & Hunt, Inc.

2.6.c Commercial Operations – Commercial operations are comprised of air carrier, commuter, and air taxi operations. Historical and projected data for commercial operations is presented in **Table 2-10**. Unscheduled operations including air taxi operations are projected using the FAA's projected CAGR of 0.9 percent (0.9%) in the number of total active GA and air taxi aircraft. Scheduled and unscheduled operation projections are combined to produce total commercial operations. Total commercial operations are projected to increase from 10,001 in 2009 to 10,622 in 2030.

Table 2-10

Commercial Aircraft Operations Projections

Year	Total: Air Carrier	Commuter / Air Taxi	Total Commercial	Scheduled Operations (OAG/T-100): Scheduled Commercial Departures	Scheduled Commercial Operations	*Percent Scheduled*	Unscheduled / Others[1]: Operations	*Percent Unscheduled*
Historical:	***Historical ATCT Records***							
2004	2,494	15,735	18,229	8,035	16,070	*88.2%*	2,159	*11.8%*
2005	2,724	15,364	18,088	7,951	15,902	*87.9%*	2,186	*12.1%*
2006	1,445	14,438	15,883	6,825	13,650	*85.9%*	2,233	*14.1%*
2007	1,164	13,337	14,501	6,383	12,766	*88.0%*	1,735	*12.0%*
2008	1,405	11,614	13,019	5,678	11,356	*87.2%*	1,663	*12.8%*
2009	861	9,140	10,001	4,326	8,652	*86.5%*	1,349	*13.5%*
	FAA Projected Growth Rate in Total Active General Aviation and Air Taxi Fleet[2]						*0.9%*	
Projected:								
2015	478	8,914	9,392	3,984	7,968	*84.8%*	1,424	*15.2%*
2020	958	8,862	9,820	4,165	8,331	*84.8%*	1,489	*15.2%*
2025	1,328	9,080	10,407	4,425	8,851	*85.0%*	1,557	*15.0%*
2030	1,574	9,048	10,622	4,497	8,994	*84.7%*	1,628	*15.3%*
CAGR 2009-2030	*2.91%*	*-0.05%*	*0.29%*	*0.18%*	*0.18%*		*0.90%*	

[1]Others is the difference between the AZO tower reported Commercial Ops and the Scheduled Ops reported by OAG/T-100. Others represents the Air Taxi/Fractional ownership aircraft

[2]FAA Aerospace Forecasts 2010-2030

Note: CAGR = Compounded annual growth rate

Sources: Historical ATCT Records - FAA Air Traffic Activity Data System (ATADS)
Historical Scheduled Commercial Operations: Official Airline Guide (OAG); US DOT T100
Projections - Mead & Hunt, Inc.

2.7 Military Operations Projections

Historically, military aircraft have not conducted a significant number of operations at the Airport. Military activity is primarily limited to contact approaches and fly-bys. The projections of total military operations at the Airport are presented in **Table 2-11**. Military operations are not necessarily contingent upon the same influences as GA or commercial operations, therefore it is anticipated that military operations will remain constant at approximately 90 operations throughout the projection period, similar to their 2009 level of 88 operations.

Table 2-11
Military Aircraft Operations Projections

	Itinerant		Local		
Year	**Operations**	**%**	**Operations**	**%**	**Total**
Historical:					
2000	213	94%	14	6%	227
2001	253	100%	1	0%	254
2002	299	97%	8	3%	307
2003	377	76%	116	24%	493
2004	163	100%	0	0%	163
2005	203	84%	40	16%	243
2006	88	62%	54	38%	142
2007	105	98%	2	2%	107
2008	87	100%	0	0%	87
2009	80	91%	8	9%	88
Avg (2000-2009)	*187*	*90%*	*24*	*10%*	*211*
				CAGR 1995-2009	*-9.99%*
Projected:					
2015	81	90%	9	10%	90
2020	81	90%	9	10%	90
2025	81	90%	9	10%	90
2030	81	90%	9	10%	90
				CAGR 2009-2030	*0.11%*

Note: CAGR = Compounded annual growth rate
Sources: Historical Military Operations - FAA Air Traffic Activity Data System (ATADS)
Projections - Mead & Hunt, Inc.

2.8 General Aviation Activity Projections

General aviation (GA) is defined as the portion of civil aviation that encompasses all types of aviation except commercial and military operations. To determine the types and sizes of facilities that should be planned to accommodate GA activity, certain elements must be projected, including based aircraft, based aircraft fleet mix, and general aviation aircraft operations

Each of these elements is discussed in more detail in the following sections.

2.8.a Based Aircraft Projections – Review of forecasts for based aircraft is useful when determining future GA facility needs. The anticipated number of hangar spaces, types of services, and sizes of GA facilities can also be derived from these forecasts. Forecasts of based aircraft are also of particular importance to the Airport as this can assist in determining future development opportunities.

Several methodologies were examined to project based aircraft, including trend line, market share, socio-economic population variable, and socio-economic income variable methodologies. All of these forecast similar projections with the exception of the trend line. After review of these methodologies, the market share model was chosen as the preferred forecasting methodology since it matches national GA trends. This methodology projects a modest CAGR of 0.94 percent (0.94%) in the number of based aircraft, commensurate with the FAA's projected increase in active GA aircraft in the U.S. at 0.94 percent (0.94%). Based aircraft are projected to increase from 149 in 2009 to 181 in 2030. **Table 2-12** summarizes the results of the various based aircraft projection methodologies.

Table 2-12
Based Aircraft Projections

Year	Historical	FAA TAF Summary	Trend Line Methodology	*Preferred* Market Share Methodology	Socio-Economic Methodology - Population Variable	Socio-Economic Methodology - Income Variable
Historical:						
1995	157					
1996	157					
1997	157					
1998	157					
1999	136					
2000	136					
2001	111					
2002	115					
2003	115					
2004	128					
2005	148					
2006	148					
2007	148					
2008	148					
2009	149					
CAGR 1995-2009	*-0.37%*					
Projected:						
2015		159	133	156	153	160
2020		169	130	162	157	171
2025		178	127	171	161	183
2030		188	124	181	165	196
CAGR 2009-2030		*1.11%*	*-0.87%*	*0.94%*	*0.49%*	*1.32%*

Notes: CAGR = Compounded annual growth rate.
Sources: Historical Based Aircraft - FAA Aerospace Forecasts
Projections - Mead & Hunt, Inc., except FAA TAF Summary which are from the FAA Terminal Area Forecast

2.8.b Based Aircraft Fleet Mix – A breakdown of historical and projected based aircraft fleet mix is presented in **Table 2-13**. The Airport has seen a decrease in the percentage of multi-engine aircraft during the study period and an increase in single-engine aircraft. The FAA has reported that the continued introduction of smaller jet engine business aircraft coupled with a strong market for business aircraft will drive general aviation in upcoming years. Though recent high fuel prices and economic concerns have impacted the GA industry, the outlook on its future remains favorable. The FAA projects total active GA aircraft will grow at a CAGR of 0.94 percent (0.94%), with the turboprop and turbojet segments exhibiting the greatest increases at 1.4 percent (1.4%) and 4.2 percent (4.2%) respectively. The based aircraft fleet mix projections for Kalamazoo take into account these national aviation trends.

Table 2-13
Based Aircraft Fleet Mix

	Single Engine		Multi-Engine		Jet		Helicopter		Other		
Year	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**Total**
Historical:											
1995	110	70%	40	25%	5	3%	2	1%	0	0%	157
1996	110	70%	40	25%	5	3%	2	1%	0	0%	157
1997	110	70%	40	25%	5	3%	2	1%	0	0%	157
1998	110	70%	40	25%	5	3%	2	1%	0	0%	157
1999	101	74%	28	21%	6	4%	0	0%	1	1%	136
2000	101	74%	28	21%	6	4%	0	0%	1	1%	136
2001	93	84%	13	12%	5	5%	0	0%	0	0%	111
2002	91	79%	17	15%	7	6%	0	0%	0	0%	115
2003	91	79%	17	15%	7	6%	0	0%	0	0%	115
2004	111	87%	10	8%	5	4%	1	1%	1	1%	128
2005	131	89%	12	8%	5	3%	0	0%	0	0%	148
2006	131	89%	12	8%	5	3%	0	0%	0	0%	148
2007	131	89%	12	8%	5	3%	0	0%	0	0%	148
2008	131	89%	12	8%	5	3%	0	0%	0	0%	148
2009	132	89%	12	8%	5	3%	0	0%	0	0%	149
Projected:											
2015	139	89%	12	8%	5	3%	0	0%	0	0%	156
2020	141	87%	15	9%	6	4%	0	0%	0	0%	162
2025	147	86%	15	9%	9	5%	0	0%	0	0%	171
2030	154	85%	16	9%	11	6%	0	0%	0	0%	181
CAGR (2009-2030)	*0.74%*		*1.47%*		*3.77%*		*0.00%*		*0.00%*		*0.94%*

Notes: CAGR = Compounded Annual Growth Rate.
1.40% CAGR (2009-2030) for Turboprops in the US Active GA & Air Taxi Fleet - FAA Aerospace Forecasts
4.20% CAGR (2009-2030) for Turbojets in the US Active GA & Air Taxi Fleet - FAA Aerospace Forecasts
Numbers may not add due to rounding
Sources: Historical Based Aircraft - FAA Terminal Area Forecasts
Projections - Mead & Hunt, Inc.

2.8.c General Aviation Operations – Another tool in determining future airfield capacity is the review of GA operation projections. For this section, GA operations encompass all activities such as corporate aviation and personal/recreational flying. Review of GA operation projections also allows an airport to review how existing GA facilities will meet future needs and determine necessary development improvements.

Historical data shows a decline in the number of GA operations since 2004. This can be attributed to a couple factors including the recent economic downturn that has reduced personal/recreational flying, and the relocation of Western Michigan University (WMU) flight school operations to the W.K. Kellogg Airport in Battle Creek. Though WMU continues to use the Airport for flight training operations, the relocation of the school has contributed to the reduction of operations historically.

Review of the GA operation projections in **Table 2-14** illustrates varying results utilizing the different methodologies. The FAA TAF, Operations per Based Aircraft (OPBA), and market share methodologies all forecast slight increases in operations. Based on the review of the forecasts, the market share methodology was selected as the preferred GA operations projection. This methodology most closely follows recent GA industry trends and provides the most reasonable forecasts of GA operations. The market share methodology projects 41,382 annual operations in 2015 with a CAGR of 1.08 percent (1.08%) through 2030, resulting in 50,325 operations.

Table 2-14
General Aviation Operations Projections

		FAA TAF Summary	Operations Per Based Aircraft Methodology			*Preferred* Market Share Methodology		
Year	**Historical**	**Total GA Ops**	**Based Aircraft**	**Operations per Based Aircraft**	**Total Operations**	**Total Operations**	**Total U.S. GA Operations**	**Market Share**
Historical:								
2000	76,828	80,515	136	565	76,828	76,828	39,878,536	0.1927%
2001	74,200	72,835	111	668	74,200	74,200	37,626,472	0.1972%
2002	74,760	75,208	115	650	74,760	74,760	37,652,701	0.1986%
2003	66,463	68,253	115	578	66,463	66,463	35,524,020	0.1871%
2004	82,981	76,414	128	648	82,981	82,981	34,967,730	0.2373%
2005	69,589	74,135	148	470	69,589	69,589	34,146,832	0.2038%
2006	53,040	57,324	148	358	53,040	53,040	33,072,516	0.1604%
2007	47,523	48,647	148	321	47,523	47,523	33,131,959	0.1434%
2008	47,427	48,312	148	320	47,427	47,427	31,667,968	0.1498%
2009	40,149	39,226	149	269	40,149	40,149	27,974,439	0.1435%
			Avg (2000-2009)	*485*				*0.18%*
Projected:								
2015		43,795	156	269	41,966	41,382	28,833,363	0.1435%
2020		46,527	162	269	43,704	44,102	30,728,860	0.1435%
2025		49,430	171	269	46,040	47,082	32,804,953	0.1435%
2030		52,518	181	269	48,835	50,325	35,064,533	0.1435%
(2009-2030)		*1.40%*	*0.94%*		*0.94%*	*1.08%*	*1.08%*	

Notes: CAGR = Compounded Annual Growth Rate
Sources: Historical Operations - Air Traffic Activity Data System (ATADS)
Total U.S. GA Operations - FAA Aerospace Forecasts FY 2010-2030
Projections - Mead & Hunt, Inc., except FAA TAF Summary which are from the FAA Terminal Area Forecast

A summary of the GA operations projections and the local/itinerant split is presented in **Table 2-15.**

Table 2-15
General Aviation Operations Projections Summary

Year	Total GA Operations	Itinerant GA Operations	Itinerant GA Percent	Local GA Operations	Local GA Percent
Historical:					
1995	75,666	38,918	51%	36,748	49%
1996	77,798	36,314	47%	41,484	53%
1997	67,304	34,080	51%	33,224	49%
1998	73,758	36,022	49%	37,736	51%
1999	84,190	38,292	45%	45,898	55%
2000	76,828	38,098	50%	38,730	50%
2001	74,200	36,415	49%	37,785	51%
2002	74,760	37,368	50%	37,392	50%
2003	66,463	31,510	47%	34,953	53%
2004	82,981	36,774	44%	46,207	56%
2005	69,589	34,330	49%	35,259	51%
2006	53,040	30,349	57%	22,691	43%
2007	47,523	24,930	52%	22,593	48%
2008	47,427	24,296	51%	23,131	49%
2009	40,149	21,391	53%	18,758	47%
		Average (1995-2009)	*50%*	*Average (1995-2009)*	*50%*
Projected:					
2015	41,382	20,607	50%	20,775	50%
2020	44,102	21,962	50%	22,140	50%
2025	47,082	23,446	50%	23,636	50%
2030	50,325	25,060	50%	25,264	50%
CAGR (2009-2030)	*1.08%*	*0.76%*		*1.43%*	

Notes: CAGR = Compounded Annual Growth Rate.
Sources: Historical Operations - Air Traffic Activity Data System (ATADS)
Projections - Mead & Hunt, Inc.

2.9 Instrument Operations

A specific element of this Master Plan Update is to develop instrument operations projections. According to the FAA, an instrument operation is one in accordance with an Instrument Flight Rule (IFR) flight plan or an operation where IFR separation between aircraft is provided by an air traffic control facility. Historical and projected instrument operations by type are presented in **Table 2-16**. Instrument operations projections are developed by multiplying the average percentage of instrument operations from 2000-2009 by the number of projected operations presented in earlier sections of this Chapter.

Table 2-16
Instrument Operations Projections

Year	Total Operations	Instrument Operations		Visual Operations	
		Operations	Percent	Operations	Percent
Historical:					
2000	99,821	36,656	37%	63,165	63%
2001	96,357	36,250	38%	60,107	62%
2002	96,817	36,709	38%	60,108	62%
2003	87,346	33,454	38%	53,892	62%
2004	101,373	30,990	31%	70,383	69%
2005	87,920	29,836	34%	58,084	66%
2006	69,065	27,495	40%	41,570	60%
2007	62,131	23,257	37%	38,874	63%
2008	60,533	22,087	36%	38,446	64%
2009	50,238	18,389	37%	31,849	63%
		Average (2000-2009)	*37%*	*Average (2000-2009)*	*63%*
Projected:					
2015	50,863	18,585	37%	32,278	63%
2020	54,012	19,736	37%	34,276	63%
2025	57,579	21,039	37%	36,540	63%
2030	61,037	22,303	37%	38,734	63%
CAGR (2009-2030)	*0.93%*	*0.92%*		*0.94%*	

Notes: CAGR = Compounded Annual Growth Rate.
Sources: Historical Operations - FAA Air Traffic Activity Data System (ATADS)
Projections - Mead & Hunt, Inc.

2.10 Air Cargo Projections

Although the Airport does not have a dedicated air cargo facility and does not receive regularly scheduled operations from large cargo aircraft, it is still important to project this type of aviation since it could have an effect (direct or indirect) on the Airport in the future. Air cargo projections allow an airport to plan for future growth within this segment of the industry and allow it to accommodate future user needs. Though no operations are anticipated by large cargo aircraft on a regularly scheduled basis over the forecasting period, occasional operations from narrow body freighters and small single- and twin-engine piston aircraft occur frequently. Also, as air cargo is shipped at the Airport in the cargo holds of commercial airliners, analysis of these projections helps to determine the capacity of existing infrastructure to meet future air cargo needs.

Historical air cargo data from the Airport illustrates the relationship between air cargo activity and the economy. Strong economic conditions found in the 1990s are illustrated by the large amount of cargo enplaned during this decade, compared to a reduced amount of cargo enplaned during the economic downturn that occurred in the years leading up to 2009. Since a positive correlation typically exists between air cargo activity and the national and global economies, growth in the economy often leads to an increased movement of goods, and thus a growth in air cargo.

The air cargo projections in **Table 2-17** assume that the market share of annual air cargo enplaned at the Airport compared to the revenue ton miles of total U.S. air cargo remains the same as the 2009 market share. Assuming this constant value of 0.0010 percent (0.0010%), air cargo is projected to increase from 136,810 pounds of enplaned cargo in 2015 to 188,187 pounds of enplaned cargo in 2030. This projection reflects the anticipated growth in the U.S. and global economies over this same time period.

Table 2-17
Air Cargo Projections

	Market Share Methodology		
Year	**Total Cargo (lbs)**	**Total U.S. Air Cargo (revenue ton miles)**	**Market Share**
Historical:			
1995	750,387	12,415,700,000	0.0060%
1996	678,319	12,781,700,000	0.0053%
1997	616,124	13,454,100,000	0.0046%
1998	502,277	13,828,100,000	0.0036%
1999	450,485	13,974,900,000	0.0032%
2000	429,945	14,698,700,000	0.0029%
2001	467,407	13,937,900,000	0.0034%
2002	311,985	12,967,400,000	0.0024%
2003	359,681	14,972,400,000	0.0024%
2004	402,981	16,340,900,000	0.0025%
2005	244,067	16,089,600,000	0.0015%
2006	236,543	15,710,500,000	0.0015%
2007	210,616	15,818,000,000	0.0013%
2008	224,424	14,410,500,000	0.0016%
2009	120,601	11,860,000,000	0.0010%
		2009 Market Share	*0.0010%*
Projected:			
2015	136,810	13,454,000,000	0.0010%
2020	152,323	14,979,600,000	0.0010%
2025	169,511	16,669,800,000	0.0010%
2030	188,187	18,506,500,000	0.0010%
CAGR 2009-2030	*2.14%*	*2.14%*	

Notes: CAGR = Compounded annual growth rate.
Sources: Historical Total Airport Cargo Data - Michigan Department of Transportation
Total U.S. Air Cargo (Revenue Ton Miles) - FAA Aerospace Forecasts FY2010-2030

2.11 Aviation Demand Peaking Characteristics

An important component of this Master Plan Update is the identification of projected peak demand times and figures. These projections are important for various facility planning purposes, as facility and equipment requirements are often determined by peak activity in a given timeframe. This section features annual, monthly, daily, and hourly peak figures of aircraft operations. Historical operational data reported to the FAA Air Traffic Activity Data System (ATADS) regarding monthly, daily, and hourly operational data as listed in the Enhanced Traffic Management System Counts (ETMSC) records was utilized to determine existing and future peak periods. A summary of peak aviation activity is presented in **Table 2-18**.

Table 2-18
Peak Month, Average Day, and Peak Hour Operations Projection

	Total Operations		Peak Month Operations	Peak Month Avg Day Operations	Avg Day Peak Hour Operations
2009					
Jan	2,222	4.42%			
Feb	3,466	6.90%			
Mar	4,563	9.08%			
Apr	3,726	7.42%			
May	4,396	8.75%			
Jun	4,347	8.65%			
Jul	5,389	10.73%			
Aug	4,789	9.53%			
Sep	5,012	9.98%			
Oct	5,010	9.97%			
Nov	4,690	9.34%			
Dec	2,628	5.23%			
Total	50,238				
		PM % (2009)	*PM (2009)*	*PMAD*	
	Peak Month Percent	*10.73%*	*5,389*	*174*	*32*
		Peak Hour Operations for each day in Jul 2009 Averaged			*18.3%*
Projected:					
2015	50,863	10.73%	5,456	176	32
2020	54,012	10.73%	5,794	187	34
2025	57,579	10.73%	6,176	199	36
2030	61,037	10.73%	6,547	211	39
CAGR (2009-2030)					

Notes: CAGR = Compounded Annual Growth Rate.
Sources: Historical Montly & Daily Operations - FAA Air Traffic Activity Data System (ATADS)
Historical Hourly Operations - FAA Enhanced Traffic Management System Counts (ETMSC)
Projections - Mead & Hunt, Inc.

2.12 Aviation Demand Summary – FAA Comparison

This Chapter provides forecasts of future aviation activity over different segments of the aviation industry through 2030. **Table 2-19** and **Table 2-20** provide a summary of the projections presented in this Chapter within the FAA's prescribed template for each forecast.

Table 2-19

FAA Template for Summarizing Airport Planning Forecasts

A. Forecast Levels and Growth Rates

Specify base year: 2009

	2009	2015	2020	2025	2030	Average CAGR			
	Base Yr. Level	Base Yr. + 6yr.	Base Yr. + 11yrs.	Base Yr. + 16yrs.	Base Yr. + 21yrs.	Base Yr. + 6yr.	Base Yr. + 11yrs.	Base Yr. + 16yrs.	Base Yr. + 21yrs.
Passenger Enplanements									
TOTAL Air Carrier & Commuter	139,712	144,623	164,286	185,862	209,100	0.6%	1.5%	1.8%	1.9%
Operations									
Itinerant									
Air carrier	861	478	958	1,328	1,574	-9.3%	1.0%	2.7%	2.9%
Commuter/air taxi	9,140	8,914	8,862	9,080	9,048	-0.4%	-0.3%	0.0%	0.0%
Total Commercial Operations	10,001	9,392	9,820	10,407	10,622	-1.0%	-0.2%	0.2%	0.3%
General aviation	21,391	20,607	21,962	23,446	25,060	-0.6%	0.2%	0.6%	0.8%
Military	80	81	81	81	81	0.2%	0.1%	0.1%	0.1%
Local									
General aviation	18,758	20,775	22,140	23,636	25,264	1.7%	1.5%	1.5%	1.4%
Military	8	9	9	9	9	1.7%	0.9%	0.6%	0.5%
TOTAL OPERATIONS	50,238	50,863	54,012	57,579	61,037	0.2%	0.7%	0.9%	0.9%
Instrument Operations	18,389	18,585	19,736	21,039	22,303	0.2%	0.6%	0.8%	0.9%
Peak Hour Operations	32	32	34	36	39	0.2%	0.7%	0.9%	0.9%
Cargo/mail (enplaned+deplaned tons)	120,601	136,810	152,323	169,511	188,187	2.1%	2.1%	2.2%	2.1%
Based Aircraft									
Single Engine (Nonjet)	132	139	141	147	154	0.8%	0.6%	0.7%	0.7%
Multi Engine (Nonjet)	12	12	15	15	16	0.6%	1.8%	1.6%	1.5%
Jet Engine	5	5	6	9	11	-1.1%	2.4%	3.4%	3.8%
Helicopter	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Other	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
TOTAL	149	156	162	171	181	0.7%	0.8%	0.9%	0.9%

B. Operational Factors

	Base Yr. Level	Base Yr. + 6yr.	Base Yr. + 11yrs.	Base Yr. + 16yrs.	Base Yr. + 21yrs.
Average aircraft size (seats)					
Air carrier & Commuter	50.2	55.0	58.0	60.0	62.0
Average enplaning load factor					
Air carrier & Commuter	64.3%	66.0%	68.0%	70.0%	75.0%
GA operations per based aircraft	269	266	272	276	278

CAGR = Compound Annual Growth Rate

Projections: Mead & Hunt

Table 2-20
FAA Template for Comparing Airport Planning and TAF Forecasts

	Year	Airport Forecast	TAF	AF/TAF (% Difference)
Passenger Enplanements				
Base Yr. Level	2009	139,712	151,681	-7.9%
Base Yr. + 6yr.	2015	144,623	160,159	-9.7%
Base Yr. + 11yrs.	2020	164,286	167,621	-2.0%
Base Yr. + 16yrs.	2025	185,862	175,465	5.9%
Base Yr. + 21yrs.	2030	209,100	183,707	13.8%
Commercial Operations				
Base Yr. Level	2009	10,001	10,482	-4.6%
Base Yr. + 6yr.	2015	9,392	10,828	-13.3%
Base Yr. + 11yrs.	2020	9,820	11,128	-11.8%
Base Yr. + 16yrs.	2025	10,407	11,435	-9.0%
Base Yr. + 21yrs.	2030	10,622	11,747	-9.6%
Total Operations				
Base Yr. Level	2009	50,238	49,785	0.9%
Base Yr. + 6yr.	2015	50,863	54,700	-7.0%
Base Yr. + 11yrs.	2020	54,012	57,732	-6.4%
Base Yr. + 16yrs.	2025	57,579	60,942	-5.5%
Base Yr. + 21yrs.	2030	61,037	64,342	-5.1%

NOTES: TAF data is on a U.S. Government fiscal year basis (October through September).
Airport forecast is on a calendar year basis.

Projections: Mead & Hunt

Chapter 3

Demand Capacity & Facility Requirements

3

Demand Capacity and Facility Requirements

Before planning can begin for future development at the Airport, existing needs must first be identified. This Chapter focuses on the evaluation of existing Airport facilities in order to identify capacity and facility requirements. Along with analyzing existing airside, terminal, and landside infrastructure and their ability to meet current user needs, this Chapter also addresses areas where improvements may be necessary to meet future demand. Identification of improvements to these areas is intended to increase safety, improve operational efficiency, and foster discussion of future development opportunities.

This Chapter reviews the following design and facility elements:

3.1 Airport Design Factors
3.2 Wind Coverage
3.3 Instrument Approaches
3.4 Federal Aviation Regulation (FAR) Part 77 Surfaces
3.5 Airfield Capacity
3.6 Runway Facilities
3.7 Taxiway Facilities
3.8 Aprons
3.9 Air Traffic Control
3.10 Navigational Aids
3.11 Airfield Lighting
3.12 Terminal Building
3.13 Aircraft Rescue and Fire Fighting (ARFF)
3.14 Airport Maintenance/Storage Facilities
3.15 General Aviation Facilities
3.16 Airport Tenants – Through the Fence Operations
3.17 Automobile Parking
3.18 Summary

3.1 Airport Design Factors

In order to achieve uniform design standards to assist pilots in familiarizing themselves with each airport's unique environment, the Federal Aviation Administration (FAA) developed Advisory Circular (AC) 150/5300-13, *Airport Design.* This AC establishes requirements and criteria for airport design to increase safety and operational utility. As a part of this AC, a coding system was developed to classify aircraft and airport design elements based on aircraft approach speeds and width of aircraft wingspans. This coding system is known as the Airport Reference Code (ARC).

Dimensions and design standards for runways and taxiways are based on the most demanding ARC category of aircraft anticipated to use the surface. The ARC is comprised of two components, the Aircraft Approach Category (AAC) and the Airplane Design Group (ADG). The AAC assigns a letter to aircraft based on their approach speeds while the ADG categorizes aircraft based on their wingspan. **Table 3-1** and **Table 3-2** illustrate the components that make up the ARC.

Table 3-1
Aircraft Approach Category (AAC)

Approach Category	Approach Speed In Knots
A	Less than 91
B	91-120
C	121-140
D	141-165
E	166 or greater

Source: FAA AC 150/5300-13

Table 3-2
Airplane Design Groups (ADG)

Group #	Wingspan (In Feet)
I	Less than 49
II	49-78
III	79-117
IV	118-170
V	171-213
VI	214-261

Source: FAA AC 150/5300-13

Current design of infrastructure at the Airport allows it to support aircraft ranging up to ARC C-III. The C-III designation represents the fleet of regional and small narrow bodied commercial aircraft that use the facility. **Table 3-3** provides a list of the types of aircraft anticipated to operate at the Airport during the planning period and their associated ARC designation. **Table 3-4** lists examples of other aircraft that utilize the Airport which are categorized under different ARC designations.

Table 3-3
Commercial Aircraft ARC Designations

Aircraft Type	ARC Designation
CRJ-200	C-II
CRJ-700	C-III
CRJ-900	C-III
Embraer 145	C-II
Embraer 175	C-III
Embraer 190	C-III
DC-9	C-III
A319	C-III
A320	C-III
737-400	C-III

Source: Mead & Hunt, Inc.

Table 3-4
General Aviation ARC Designations

ARC Designation	Aircraft Examples
A-I	Cessna 172, Cirrus SR-22, Beech Bonanza
B-II	Beech King Air, Falcon 900, Cessna Citation
C-II	Falcon 2000, Challenger 300, ERJ-135
C-III	Boeing BBJ, Global Express, Gulfstream III

Source: Mead & Hunt, Inc.

3.2 Wind Coverage

A primary factor in analyzing facility requirements is reviewing how the orientation of runways at an airport meets local wind conditions. Since pilots prefer to land and takeoff into the wind, it is desirable for an airport to have runways aligned to meet local prevailing winds. FAA AC 150/5300-13, *Airport Design*, recommends that airports have runways that are aligned to provide 95 percent (95%) coverage of local winds.

In reviewing whether the orientation of runways meet 95 percent (95%) coverage of local winds, crosswind components of 10.5 knots, 13 knots, and 16 knots are analyzed. These three crosswind components represent the maximum allowable crosswind for different types of aircraft. Smaller, single engine aircraft are more susceptible to crosswinds and are represented by the 10.5 knot component, while larger twin engine and smaller jet aircraft are represented by the 13 knot component. Larger jet aircraft are representative of the 16 knot crosswind component.

In reviewing these crosswind components for the orientation of runways at the Airport during all weather conditions, it was found that Runways 17/35, 5/23, and 9/27 provide 99.7 percent (99.7%) of wind coverage at 10.5 knots. At 13 knots, Runways 17/35 and 5/23 provide 99 percent (99.0%) coverage. Runway 9/27 was omitted from this analysis since aircraft representative of this component are unable to land and takeoff on the runway due to its shorter length. At the 16 knot component, Runway 17/35 provides 98.8 percent (98.8%) coverage. Runways 5/23 and 9/27 were omitted from the 16 knot crosswind analysis due to the lack of runway length needed for aircraft representative of this component. **Table 3-5** illustrates crosswind coverage for all runways at the Airport.

Table 3-5
Wind Coverage – All Weather

<table>
<tr><th>Crosswind Component</th><th>Aircraft Type Most Affected</th><th>Rwy 17</th><th>Rwy 35</th><th>Rwy 5</th><th>Rwy 23</th><th>Rwy 9</th><th>Rwy 27</th></tr>
<tr><td rowspan="4">10.5 knots</td><td rowspan="4">Small GA</td><td>68.2</td><td>58.1</td><td>53.3</td><td>76.2</td><td>57.2</td><td>76.8</td></tr>
<tr><td colspan="2">91.2</td><td colspan="2">91.3</td><td colspan="2">90.7</td></tr>
<tr><td colspan="4">96.8</td><td></td><td></td></tr>
<tr><td colspan="6">99.7</td></tr>
<tr><td rowspan="3">13 knots</td><td rowspan="3">Corporate GA</td><td>68.2</td><td>58.1</td><td>53.3</td><td>76.2</td><td></td><td></td></tr>
<tr><td colspan="2">95.5</td><td colspan="2">95.6</td><td></td><td></td></tr>
<tr><td colspan="4">99.0</td><td></td><td></td></tr>
<tr><td rowspan="2">16 knots</td><td rowspan="2">Commercial</td><td>68.2</td><td>58.1</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">98.8</td><td></td><td></td><td></td><td></td></tr>
</table>

Note: Tailw ind Component 3 knots on single runw ay end coverages
Source: National Climatic Data Center, FAA Standard Wind Analysis tool
Station: Kalamazoo, MI
Period of Record: 2000-2009; 81,040 All Weather Observations

It should be noted that in a 10.5 knot crosswind, Runways 17/35 and 5/23 provide 96.8 percent (96.8%) wind coverage during all weather conditions. This illustrates that Runway 17/35 and Runway 5/23 meet the 95 percent (95%) criteria. During Visual Flight Rules (VFR) conditions, Runways 17/35 and 5/23 provide 96.9 percent (96.9%) of coverage in a 10.5 knot crosswind while during Instrument Flight Rules (IFR) conditions these two runways provide 96.1 percent (96.1%) coverage. This should be considered when reviewing alternatives for development which are presented in Chapter 4. **Table 3-6** and **Table 3-7** present the wind coverage analyses for VFR and IFR conditions.

Table 3-6
Wind Coverage – VFR Conditions

<table>
<tr><th>Crosswind Component</th><th>Aircraft Type Most Affected</th><th>Rwy 17</th><th>Rwy 35</th><th>Rwy 5</th><th>Rwy 23</th><th>Rwy 9</th><th>Rwy 27</th></tr>
<tr><td rowspan="4">10.5 knots</td><td rowspan="4">Small GA</td><td>68.4</td><td>58.0</td><td>53.0</td><td>76.9</td><td>56.8</td><td>77.5</td></tr>
<tr><td colspan="2">91.4</td><td colspan="2">91.4</td><td colspan="2">90.6</td></tr>
<tr><td colspan="4">96.9</td><td></td><td></td></tr>
<tr><td colspan="6">99.7</td></tr>
<tr><td rowspan="3">13 knots</td><td rowspan="3">Corporate GA</td><td>70.8</td><td>60.6</td><td>54.6</td><td>80.4</td><td></td><td></td></tr>
<tr><td colspan="2">95.6</td><td colspan="2">95.6</td><td></td><td></td></tr>
<tr><td colspan="4">99.1</td><td></td><td></td></tr>
<tr><td rowspan="2">16 knots</td><td rowspan="2">Commercial</td><td>72.8</td><td>62.9</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">98.9</td><td></td><td></td><td></td><td></td></tr>
</table>

Note: Tailwind Component 3 knots on single runway end coverages
Source: National Climatic Data Center, FAA Standard Wind Analysis tool
Station: Kalamazoo, MI
Period of Record: 2000-2009; 70,905 VFR Weather Observations
VFR = Ceiling greater than or equal to 1000 feet and visibility greater than or equal to 3 statute miles.

Table 3-7
Wind Coverage – IFR Conditions

<table>
<tr><th>Crosswind Component</th><th>Aircraft Type Most Affected</th><th>Rwy 17</th><th>Rwy 35</th><th>Rwy 5</th><th>Rwy 23</th><th>Rwy 9</th><th>Rwy 27</th></tr>
<tr><td rowspan="3">10.5 knots</td><td rowspan="3">Small GA</td><td>65.7</td><td>58.3</td><td>54.5</td><td>70.4</td><td>57.9</td><td>71.6</td></tr>
<tr><td colspan="2">89.3</td><td colspan="2">90.4</td><td colspan="2">91.5</td></tr>
<tr><td colspan="4">96.1</td><td></td><td></td></tr>
<tr><td rowspan="3">13 knots</td><td rowspan="3">Corporate GA</td><td>68.6</td><td>61.6</td><td>56.1</td><td>73.9</td><td></td><td></td></tr>
<tr><td colspan="2">94.3</td><td colspan="2">95.1</td><td></td><td></td></tr>
<tr><td colspan="4">98.8</td><td></td><td></td></tr>
<tr><td rowspan="2">16 knots</td><td rowspan="2">Commercial</td><td>71.1</td><td>64.6</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">98.5</td><td></td><td></td><td></td><td></td></tr>
</table>

Note: Tailwind Component 3 knots on single runway end coverages
Source: National Climatic Data Center, FAA Standard Wind Analysis tool
Station: Kalamazoo, MI
Period of Record: 2000-2009; 9,345 IFR Weather Observations
IFR = Ceiling less than 1000 feet but greater than or equal to 200 feet and/or visibility less than 3 statue miles but greater than or equal to 1/2 statute mile.

3.3 Instrument Approaches

Reviewing instrument approaches at an airport is an important element when analyzing demand capacity. Instrument approaches allow properly equipped aircraft to land during times of reduced visibility, nighttime, and inclement weather conditions, thus increasing capacity. Instrument approaches also decrease the minimum visibility and cloud ceiling heights required to conduct a landing, also known as minimums. Ground equipment installed at airports can provide for two types of instrument approaches: non-precision and precision. Non-precision instrument approaches are those that provide horizontal guidance for an aircraft to properly align with the runway while precision approaches provide both horizontal and vertical guidance.

Instrument approaches are developed and published by the FAA and can utilize a variety of navigational equipment. Non-precision approaches can be developed with ground based navigational equipment such as a VOR (Very High Frequency Omni-directional Radio Range), NDB (non-directional beacon), or Localizer (LOC) or through satellite navigation utilizing GPS (Global Positioning System) signals.

At the Airport, only Runway 35 is equipped with a precision instrument approach. Runway ends 5, 23, and 35 are equipped with non-precision instrument approaches while no instrument approaches have been development for Runway ends 9 and 27. An Instrument Landing System (ILS) installed on Runway 35 allows properly equipped aircraft to land at the Airport with minimums of a half-mile and a 200 foot ceiling. The Area Navigation (RNAV) GPS approaches to Runway 17 offers the ability for aircraft to conduct an instrument approach with a visibility minimum of one mile and a ceiling height of 500 feet while a visibility minimum of a half -mile and a ceiling height of 300 feet is needed to conducted the RNAV (GPS) approach to Runway 35. Runway 5 and Runway 23 offer RNAV GPS approaches with the same visibility minimums of one (1) mile, but offer lower ceiling height minimums of 400 feet. Approaches utilizing VOR equipment allow landings to be conducted with visibility minimums as low as 3/4 mile and ceilings of 500 feet. **Table 3-8** lists the instrument approaches to the Airport and their associated minimums.

Table 3-8
Instrument Approaches

Approach	Minimum Visibility	Minimum Ceiling Height
ILS or Localizer Runway 35	1/2 mile	200 feet
RNAV (GPS) Runway 17	1 mile	500 feet
RNAV (GPS) Runway 35	1/2 mile	300 feet
RNAV (GPS) Runway 5	1 mile	400 feet
RNAV (GPS) Runway 23	1 mile	400 feet
Localizer Back Course Runway 17	1 mile	500 feet
VOR Runway 5	1 mile	500 feet
VOR Runway 17	1 mile	500 feet
VOR Runway 23	1 mile	500 feet
VOR Runway 35	3/4 mile	500 feet
NDB Runway 35	3/4 mile	500 feet

Source: FAA Approach Procedures, May 2010

Existing instrument approaches are anticipated to meet the needs of Airport users during the planning period, although improved minimums for Runway 17 would improve the all-weather capability of the Airport's primary runway. With the improved minimums being offered by GPS approaches, it is recommended that the Airport look to enhance the Runway 17 approach minimums down to 3/4 of a mile.

It is recommended that the Airport maintain clear approaches to all runway ends in anticipation of development of future approach procedures. Approach procedures utilizing satellite navigation are foreseen to allow instrument approaches to be developed for runways without installation of ground based equipment. A proactive approach of maintaining clear runway approaches and monitoring of surrounding land uses positions the Airport well for the addition of precision approaches by the FAA.

3.4 Federal Aviation Regulation (FAR) Part 77 Surfaces

Three dimensional surfaces defined in FAA's Federal Aviation Regulation (FAR) Part 77 protect airspace surrounding an airport from obstructions that could interfere with aircraft operations. Keeping these designated airspaces free from objects allows an airport to maintain or increase capacity. Obstructions such as trees, buildings, and towers that impact Part 77 surfaces can prevent instrument approaches from being developed or modify or eliminate existing approaches that can lead to a reduction in capacity.

FAR Part 77 defines five surfaces that protect airspace surrounding airports from obstructions. The dimensions of the surfaces are based upon the type of approach to each runway end. The following sections provide a more detailed description of each surface and their associated dimensions:

3.4.a Primary Surface – The primary surface is one dimensional and centered longitudinally on the runway centerline and lies at the same elevation as the runway. The length of the surface is the same length of runway with no prepared hard surface. For runways with prepared hard surfaces, the length extends 200 feet beyond each runway end. The width of surface varies between 250 feet to 1,000 feet based on the type of runway and type of runway approach.

3.4.b Approach Surface – The approach surface is centered longitudinally on the runway centerline and extends upward beyond each runway end. The slope of the surface is dependent on the type of approach to the runway end and measures at a ratio of 20:1, 34:1, or 50:1. The horizontal distance of the surface also varies on the type of runway approach and can be from 5,000 feet to 50,000 feet in length.

3.4.c Transitional Surface – The transitional surface also extends upward and outward, but perpendicular to the runway. The slope of this surface extends at a 7:1 ratio from the side of the primary and approach surfaces. The surface extends vertically until a height of 150 feet above the elevation of the runway.

3.4.d Horizontal Surface – The horizontal surface begins 150 feet above the elevation of the runway at the termination of the transitional surface. The surface extends outward horizontally from the transitional surface to a perimeter that is established by generating arcs from the end of each primary surface and connecting the arcs with lines of tangent. The radii of the arcs are 5,000 feet in length for utility and visual runways and 10,000 feet in length for all other types of runways.

3.4.e Conical Surface – The conical surface extends outward and upward from the outermost perimeter of the horizontal surface at a 20:1 slope for a horizontal distance of 4,000 feet.

Table 3-9 lists the dimensions of these surfaces while **Figure 3-1** and **Figure 3-2** provide a graphical representation of these surfaces.

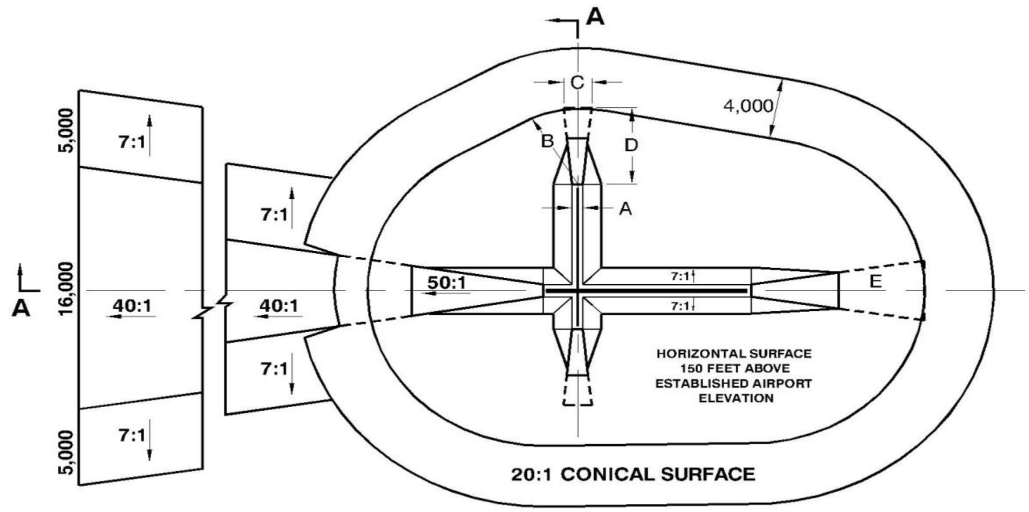
Table 3-9
FAR Part 77 Surfaces

DIM	Item	Dimensional Standards (Feet)					
		Visual Runway		Non-Precision Instrument Runway			Precision Instrument Runway
		A	B	A	B		
					C	D	
A	Width of Primary Surface and Approach Surface Inner Width	250	500	500	500	1,000	1,000
B	Radius of Horizontal Surface	5,000	5,000	5,000	10,000	10,000	10,000
C	Approach Surface Outer Width	1,250	1,500	2,000	3,500	4,000	16,000
D	Approach Surface Length	5,000	5,000	5,000	10,000	10,000	*
E	Approach Slope	20:1	20:1	20:1	34:1	34:1	*

Notes:
A – Utility Runways
B – Runways Larger Than Utility
C – Visibility Minimums Greater Than 3/4 Mile
D – Visibility Minimums as Low as 3/4 Mile
* - Precision Instrument Approach Slope is 50:1 for inner 10,000 Feet and 40:1 for an additional 40,000 Feet.

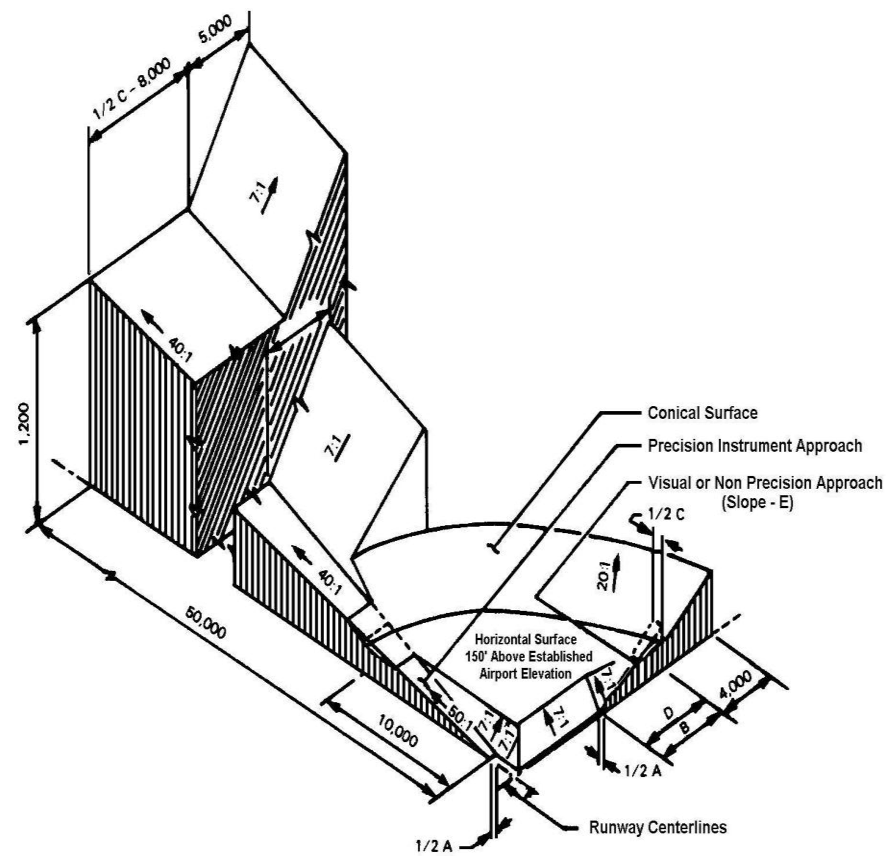
Source: FAR Part 77

Figure 3-1
FAR Part 77 Surfaces – Plan View



Source: FAR Part 77

Figure 3-2
FAR Part 77 Surfaces – Three Dimensional View



Source: FAR Part 77

Although the FAA has established these surfaces to protect airspace surrounding an airport from obstructions, it is important to note that the FAA has no legal authority to prevent or remove obstructions. The responsibility to prevent or remove obstructions lies with the Airport and the local community. Cooperation between the Airport, local and State government and agencies, and the surrounding community is imperative in protecting the airspace around the Airport.

In 2009, surveys were conducted in the approach to each runway end to identify objects that penetrated these five FAR Part 77 surfaces. As part of this project, obstructions to these surfaces that were located on Airport property were lowered or removed completely. Obstructions outside of Airport property remain, and should be mitigated through easements or fee acquisition, if necessary. **Table 3-10** lists some of the remaining obstructions to these surfaces for each runway approach.

Table 3-10
Airport Approach Obstructions

<table>
<tr><th>Runway Approach</th><th>Obstruction</th><th>Approximate Location</th></tr>
<tr><td rowspan="2">Runway 5</td><td>Utility Poles</td><td>Along Portage Road</td></tr>
<tr><td>Trees</td><td>South of Hinman Hangar</td></tr>
<tr><td>Runway 9</td><td>Trees</td><td>1,000 ft south of Portage Rd.</td></tr>
<tr><td>Runway 17</td><td>Trees</td><td>Along Interstate 94</td></tr>
<tr><td>Runway 23</td><td>Trees</td><td>Along Railroad Line</td></tr>
<tr><td>Runway 27</td><td>Trees</td><td>Along Railroad Line</td></tr>
<tr><td rowspan="3">Runway 35</td><td>Railroad</td><td>700 ft SE of Runway End</td></tr>
<tr><td>Utility Poles</td><td>Along Closed Mastenbrook Dr.</td></tr>
<tr><td>Trees</td><td>Along Romence Rd. & 1,600 ft SE of Runway End</td></tr>
</table>

Source: Mead & Hunt, Inc.

3.5 Airfield Capacity

Airfield capacity is the number of aircraft operations the runway and taxiway system can accommodate before delays become unreasonable. As demand approaches capacity, delays in arrivals and departures increase to a point where an airport is unable to accommodate additional demand. To assist airports in planning for airfield development that can maintain or increase capacity, an analysis of the existing runway and taxiway system is conducted to determine its ability to meet future demand. As a general rule, if future activity reaches 60 percent (60%) of the airfield's capacity, planning should be initiated so that implementation can begin when 80 percent (80%) capacity is reached.

Using FAA airport design software, the annual service volume (ASV) or estimated capacity of the airfield is approximately 225,000 operations. Based on the forecasts presented in Chapter 1, it is not anticipated that operations at the Airport will exceed the capacity of the airfield during the planning period. The current configuration of the runway and taxiway system and its current capacity is projected to be able to meet future demand.

It should be noted that the ASV was calculated using a two runway airfield configuration similar to the layout of Runways 17/35 and 5/23 due to limitations in the software. This limitation allows a capacity analysis to be conducted to evaluate the ability of the Airport to meet future demand with a decommissioning of Runway 9/27. Though several other factors such as local wind conditions, number of operations from existing and anticipated aircraft types, and the necessity of the runway for air traffic control procedures must be evaluated when considering to decommission a runway, the results from the capacity analysis illustrate that Runways 17/35 and 5/23 will be able to meet anticipated demand through the planning period.

3.6 Runway Facilities

One of the most important assets of an airport is its runway facilities. Without these important pieces of infrastructure, an airport would be unable to remain open and serve the needs of its users. This section seeks to define the components of a runway system and identify areas where improvements may be needed to meet existing and future demands.

- **Runway Length and Width –** Runway length and width requirements are based on several factors including elevation of the airfield, average temperature, aircraft type, runway takeoff and landing distance requirements based on manufacturer recommendations, and design standards as defined in AC 150/5300-13, *Airport Design*.

- **Surface and Strength –** The surface and strength of a runway is dependent upon the maximum gross takeoff weight and landing gear configuration of aircraft anticipated to use the surface. Runway surfaces are constructed to support aircraft loads over a period of 20 years. Surfaces are typically turf, asphalt, or concrete (which is preferred for the heaviest loads). Typically, a runway surface and strength is based upon the number of departures by the critical design aircraft.

- **Runway Safety Area (RSA) –** The runway safety area is a graded area surrounding a runway designed to protect aircraft in the event of an unintended excursion from the runway surface. The dimensions of this area are based upon design standards in AC 150/5300-15, *Airport Design*, of the most demanding critical design aircraft to use the runway. Safety areas must be:

    - Clear and graded of all hazardous humps, ruts, depressions, or other surface variations
    - Able to drain surface water to prevent accumulation
    - Capable of supporting aircraft, snow removal equipment, and Airport Rescue and Fire Fighting (ARFF) equipment

  - Free of objects, except those necessary for function, which must be mounted on frangible bases

- **Runway Object Free Area (ROFA) –** The ROFA is a two-dimensional surface surrounding a runway at the same elevation of the safety area that prohibits objects from being placed near the runway environment. Only objects necessary for aircraft navigational purposes such as signs, equipment, and taxiing aircraft are permitted. The size of a ROFA is based upon the ARC of the critical design aircraft as defined in AC 150/5300-13, *Airport Design*.

- **Runway Obstacle Free Zone (ROFZ) –** The Runway Obstacle Free Zone is a designated three-dimensional area centered on the runway that protects object penetration into the runway environment and approach areas. The ROFZ projects upwards and outwards at a ratio that is determined based on type of runway, visibility minimums, and type of runway approach and is the same width as the ROFA. All objects, including parked and taxiing aircraft, are not allowed in this volume of airspace.

- **Runway Protection Zone (RPZ) –** The RPZ is a trapezoidal surface that extends outward from the approach end of the runway that is designed to protect aircraft, people, and property on the ground by clearing this area of incompatible land uses. The FAA requires airport operators to have sufficient interest in the control of activities in this area through property interest or avigation easements to prevent incompatible uses. Some land uses (such as agricultural activities) are allowed in this area while other uses (such as residential developments, churches, schools) and objects of height (such as trees, towers, and tall buildings) are prohibited. The size of an RPZ is based on design standards as defined in AC 150/5300-13, *Airport Design*.

3.6.a Runway 17/35 – Runway 17/35 is the primary runway at the Airport and is designed for aircraft ranging up to the ARC C-III category. The following sections break down the design standards of the previously mentioned runway components:

- **Runway Length and Width –** Runway 17/35 is 6,502 feet long and 150 feet wide. The FAA design standard for width of a C-III runway is 150 feet for those serving aircraft with maximum certificated takeoffs weights in excess of 150,000 pounds. In 2009, the Airport had regular scheduled service by the Airbus A320 with a maximum takeoff weight of over 170,000 pounds. Therefore the runway width at 150 feet meets FAA design standards for the existing and projected fleet.

  To determine the adequacy of the existing runway length, specific runway length requirements have been documented based upon guidance from FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, and information from aircraft manufacturers. FAA AC 150/5325-4B states the following regarding recommended runway lengths:

> "Airplanes today operate on a wide range of available runway lengths. Various factors, in turn, govern the suitability of those available runway lengths, most notably airport elevation above mean sea level, temperature, wind velocity, airplane operating weights, takeoff and landing flap settings, runway surface condition (dry or wet), effective runway gradient, presence of obstructions in the vicinity of the airport, and, if any, locally imposed noise abatement restrictions or other prohibitions."

The following summarizes some of the important concepts from AC 150/5325-4B in regards to regular use and FAA recommended runway length:

- The goal is to construct an available runway length for new runways or extensions to existing runways that is suitable for the forecasted critical design airplanes
- The critical design airplanes (or a single airplane) are the aircraft that result in the longest recommended runway length
- Federally funded projects require that critical design airplanes have at least 500 or more annual itinerant operations for an individual or a family grouping of airplanes
- The design objective for the main primary runway is to provide a runway length for all airplanes that will regularly use it, without causing operational weight restrictions

The runway length requirements associated with the current air carrier and commuter turbo jet fleets were evaluated to determine the adequacy of the existing 6,502-foot primary runway.

Table 3-11 summarizes the 2009 scheduled commercial turbo jet operations by aircraft type, and the approximate runway length requirements for each type at the Airport on a hot day. The table lists the regional jet aircraft (ERJ145, CRJ100/200, and CRJ900) which are currently operating at the Airport along with the heavier narrow body aircraft. Delta Airlines isn't flying the DC9 to the Airport regularly anymore, instead they are flying regional jet aircraft. The A320 and other similar narrow body aircraft are utilized by Direct Air for service on long haul markets, particularly to Florida. **Table 3-11** also lists other regional jet type aircraft which aren't currently operating at the Airport, but which are prominent in the commuter and regional jet fleets, and could reasonably be anticipated to operate at the Airport during the planning period.

The distances listed in **Table 3-11** are based on the approximate longest runway length needed for aircraft to takeoff or land at maximum gross takeoff weight as specified by the aircraft manufacturers. The table also takes into consideration safety margins as recommended by FAA Safety Alert for Operators (SAFO) 06012, *Landing Performance Assessments at Time of Arrival (Turbojets)* that documents runway surface assessment procedures for turbojet aircraft operations with calculating landing distances. Safety margins of an additional 15 percent (15%) distance for wet surfaces and 20 percent (20%) distance for surfaces with compact snow are recommended to be taken into account when pilots perform landing distance calculations at time of arrival. These have been included in the table to illustrate the runway distance that these aircraft would need taking this recommendation into consideration. Distances that are longer than the existing length offered by Runway 17/35 are shown in bold text.

Table 3-11
Runway Length Needs – Commercial Aircraft

Aircraft Type	Takeoff Wt (lb)	Landing Distance with 15% Safety Margin for Wet Pavement	Landing Distance with 20% Safety Margin for Compact Snow	Approximate Takeoff Distance[1] (MTOW, Hot Day)	2009 Operations
Current Fleet (2009)					
ERJ145	48,502	5,500	5,700	**7,500**	3,252
CRJ100/200	53,000	5,800	6,000	**7,500**	3,582
CRJ900	82,500	**7,100**	**7,400**	**7,500**	560
DC9-50	121,000	6,100	6,400	**9,500**	2
A320	170,637	5,700	5,900	**7,300**	114
				Total	7,510
Potential Future Operators/Fleet					
CRJ700	75,000	5,800	6,000	6,400	
E170 (LR)	82,012	NA	NA	6,400	
E175 (LR)	85,517	NA	NA	**7,000**	
E190 (LR)	110,893	NA	NA	**7,400**	
E195 (LR)	111,973	NA	NA	**8,100**	
CS100	121,100	5,500	5,800	6,200	
CS100 (ER)	128,200	5,500	5,800	6,200	
CS300	131,800	5,900	6,200	**7,700**	
CS300 (XT)	131,800	5,900	6,200	**6,800**	
CS300 (ER)	139,600	5,900	6,200	**7,700**	
MD-83	160,000	5,800	6,000	**9,000**	
A319	162,921	5,500	5,700	**7,000**	
B737-800	174,200	6,500	**6,800**	**8,000**	

[1]Takeoff length requirements based upon 874 MSL airport elevation, 85 deg F temperature, 9-foot runway gradient

Note: Hot Day Takeoff Requirements (ISA + 15 deg C)
Distances longer than 6,502 feet are bolded.

Source: Aircraft Manufacturer Performance Manuals; except for E170, E175, E190, and E195 which have been approximated for a hot day at the Airport from manufacturer published takeoff requirements for sea level, standard temperature day (ISA) using typical conversion factors.

As illustrated by the table, all of the scheduled commercial turbojet aircraft require more runway length than the 6,502 feet that is available, to operate at maximum gross takeoff weight on a hot day. Though these aircraft cannot takeoff at their maximum takeoff weight, they can still use the Airport by making concessions in terms of enplaned passengers, reduced fuel load, or reduced cargo. These concessions impact the level of service that can be offered as it reduces the number of passengers that can be carried by the operator and/or reduces the range of the aircraft, which limits the markets that can be profitably served carriers.

FAA Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design*, states: "The design objective for the main primary runway is to provide a runway length for all airplanes that will regularly use it without causing operational weight restrictions." Substantial use is also defined as 500 annual itinerant operations. As shown in **Table 3-11**, the Airport had 7,510 operations in 2009 by aircraft types which have operational weight restrictions due to the existing length of Runway 17/35. Therefore additional runway length on the main primary runway is necessary to eliminate these operational weight restrictions.

A runway length of 7,500 feet, approximately 1,000 feet more than the current 6,502 feet available, meets the substantial use threshold, as more than 500 annual iterant operations require this amount of runway length.

Additional runway length will allow aircraft to operate with greater passenger and fuel loads, increasing markets that can be served. The current runway length is sufficient only for the existing and anticipated fleet of commercial aircraft to reach short-range destinations, however medium and long range markets, require additional runway length for most of these aircraft types.

As noted above, 7,500 feet of runway length appears to accommodate the vast majority of the existing and anticipated fleet. It is recommended that planning occur for up to 1,000 feet of additional runway length.

- **Surface, Strength, and Condition –** Runway 17/35 is a prepared hard surface paved in asphalt that has a weight bearing capacity based on the main landing gear configuration of aircraft. The runway is able to support aircraft weighing 85,000 pounds for single wheel gear configurations, 121,000 pounds for dual wheel gear configurations, and 240,000 pounds for dual tandem wheel configurations. Since these weight bearing capacities are greater than the maximum gross takeoff weights of existing and anticipated aircraft operating at the Airport, the strength of the runway is sufficient to meet demands through the planning period.

  In 2007, an inspection was conducted of the pavement surfaces at the Airport. Runway 17/35 was found to be in "good" condition with moderate quantities of longitudinal and transverse (L&T) cracking observed. In addition, small quantities of block cracking, alligator cracking, patching, raveling and weathering were recorded. The remaining pavement section, located at the approach end of Runway 35, was recently constructed and is in excellent condition. Overall, the surface of Runway 17/35 was given a Pavement Condition Index (PCI) rating of 67 based on a scale from 0 to 100 with 100 representing pavement in excellent condition. Though the runway is not anticipated to need significant attention through the next five (5) to ten (10) years other than routine maintenance, it is anticipated that a rehabilitation of the runway may be necessary towards the end of the planning period.

- **Runway Safety Area (RSA) –** The dimensions of the RSA for Runway 17/35 are based on ARC category C-III criteria since this is the most demanding type of aircraft that uses the surface at this time. Based on these criteria, the RSA extends 1,000 feet beyond each runway end for a total of 8,502 feet at a width of 500 feet. A recent project that was completed in 2008 shifted the runway to allow for the additional 1,000 foot safety area beyond each runway end. The safety area currently meets standards and no improvements are necessary at this time.

- **Runway Object Free Area (ROFA) –** The ROFA for Runway 17/35 is also based upon the ARC C-III design criteria. The ROFA also extends 1,000 feet beyond each runway end and has a width of 800 feet. The existing ROFA meets these standards and no improvements are necessary at this time.

- **Runway Obstacle Free Zone (ROFZ) –** The dimensions of a ROFZ are based upon the approach and type of runway. The length of the ROFZ for Runway 17/35 extends 200 feet beyond each runway end for a total of 6,902 feet at a width of 400 feet.

  Since Runway 35 is equipped with an approach lighting system, an inner-approach obstacle free zone (OFZ) applies that begins 200 feet beyond the end of the runway and extends 200 feet beyond the last light unit in the lighting system. The width of the inner-approach OFZ is 400 feet and rises at a slope of 50:1.

  An inner-transitional OFZ applies to the Runway 35 inner-approach OFZ that begins at the edges of the ROFZ and inner-approach OFZ and rises vertically to a height of 47 feet, then slopes outward at a 6:1 slope to a height of 150 feet. A precision OFZ is found at the end of the runway threshold when visibility is less than 3/4 mile and an aircraft is on final approach within two miles of the runway end. The precision OFZ is 200 feet long by 800 feet wide and must be free of objects when in effect.

  All ROFZ dimensions for the runway meet standards and no changes are necessary at this time.

- **Runway Protection Zone –** The RPZ for each end of Runway 17/35 varies due to the differences in approach visibility minimums. For Runway 17, the dimension of the RPZ is 1,700 feet in length, 500 feet wide at the inner width, and 1,010 feet wide at the outer width. Improving the approach minimums for Runway 17 from 1-mile visibility to ¾-mile visibility (discussed below) would increase the size of the RPZ to 1,700 feet in length, 1,000 feet inner width, and 1,510 feet outer width. For Runway 35, the dimension of the RPZ is 2,500 feet in length, 1,000 feet wide at the inner width, and 1,750 feet at the outer width.

- **Runway 17 RPZ –** The Runway 17 RPZ currently does not have any incompatible land uses within it; however it does extend over Kilgore Road and the Kilgore Service Drive. It also extends over the truck and trailer parking area of the Ryder Trucking Company located on the north side of Kilgore Road at 2211 E Kilgore Rd. The airport currently owns an avigation easement over this property which is identified as Easement 20 on the Airport's Exhibit A property map. However, while the easement limits heights of structures and natural growth it does not limit land use or the construction of incompatible structures within the RPZ.

  It is recommended that approach visibility minimums to Runway 17 be improved down to 3/4 mile. If approach minimums are improved, the width of the RPZ will increase. The larger RPZ will include some undeveloped Pfizer property to the east of Ryder Trucking and also some open land and a parking lot owned by Kilgore Point LLC at 1919 Kilgore Service Rd, on the west side of the approach. Similar to the Ryder property, the Airport owns avigation easements over these properties limiting heights, Easement 4 over the Pfizer property and Easements 21 and 40 over the Kilgore Point LLC property. Easement 40 along the eastern edge of the Kilgore Point LLC property limits all growth and structures allowing only vehicle parking and farming on the land, however the other easements do not limit the development of incompatible structures within the RPZ. It is recommended that the Airport increase their interest in these properties within the future RPZ through more restrictive easements or fee acquisition.

- **Runway 35 RPZ –** The Runway 35 RPZ currently does not have any incompatible land uses within it; however it does include some railroad tracks owned by Pfizer. Also the RPZ's eastern edge (to the east of the railroad tracks) encompasses the back portion of two parcels, one owned by Mueller Refrigeration and the other by the City of Portage. The Airport currently owns an avigation easement over these properties which are identified as Easement 9 on the Airport's Exhibit A property map. However, while the easement limits heights of structures and natural growth it does not limit land use or the construction of incompatible structures within the RPZ. It is recommended that the Airport increase their interest in these properties within the future RPZ through either clear-zone easements or fee acquisition.

3.6.b Runway 5/23 – Runway 5/23 is the main crosswind runway designed for aircraft ranging up to the ARC B-II category. The following identifies the design standards for this runway:

- **Runway Length and Width –** Runway 5/23 is 3,438 feet long and 100 feet wide. The length and width of this runway allows it to serve the crosswind needs of single- and twin-engine aircraft. While further extension of the runway is limited due to land uses surrounding the Airport, the length and width adequately serves the needs of users.

- **Surface, Strength, and Condition –** Runway 5/23 is a prepared, hard surface paved with asphalt capable of supporting aircraft up to 30,000 pounds with a single wheel main landing gear configuration, 45,000 pounds with a dual wheel gear configuration, and 60,000 pounds with a dual tandem configuration. Improvements to the strength of the runway or type of pavement material to support greater weights are not anticipated to be required during the planning period.

  The condition of the runway was rated as "good" during the 2007 inspection of Airport surfaces with quantities of pavement cracking observed. A PCI rating of 88 was assigned to runway based on this inspection. No significant improvements to the condition of the surface other than routine maintenance are anticipated to be necessary during the planning period.

- **Runway Safety Area –** The size of the RSA for Runway 5/23 is based on ARC B-II design characteristics and the approach minimums to the runway. With approach minimums not lower than one (1) mile, the corresponding safety area for Runway 5/23 is 150 feet wide and extends 300 feet beyond each runway end. The current safety area meets standards, however at the Runway 5 approach end there is pavement and taxiway access behind the threshold and holding locations on both Taxiway C and Taxiway F that are holding positions for two runways (5/23 and 9/27). Holding positions for two runways are considered potential safety concerns by the FAA. Taxiway geometry alternatives at the Runway 5 and Runway 9 threshold are discussed in Chapter 4.

- **Runway Object Free Area –** The ROFA for Runway 5/23 also extends 300 feet beyond each runway end, but has a larger width at 500 feet. These dimensions meet FAA design standards and no improvements are necessary at this time.

- **Runway Obstacle Free Zone –** The ROFZ for Runway 5/23 extends 200 feet beyond each end of the runway and has a width of 200 feet. This meets standards for runways serving up to ARC category B-II aircraft. No improvements to the ROFZ are necessary at this time.

- **Runway Protection Zone –** Runway 5/23 has the same type of approach to either end of the runway, so the dimensions of both RPZs are also the same. Both RPZs begin 200 feet beyond the end of the runway pavement and extent to a length of 1,000 feet. The inner widths of both RPZs are 500 feet, while the outer widths are 700 feet. The dimensions of the RPZs meet standards for ARC approach category B aircraft with the runway having an approach visibility minimum of not lower than one (1) mile.

- **Runway 5 RPZ –** The Runway 5 RPZ overlies Portage Road and a portion of the Beacon Club restaurant building and property. Since the Beacon Club restaurant holds a large number of people, it is considered an incompatible land use within the Runway 5 RPZ. The Airport currently owns an avigation easement (identified as Easement 26 on the Airport's property map) over the Beacon Club property which limits the heights of buildings and natural growth; the easement does not contain any limitations on the expansion of incompatible facilities below certain heights. Given that the existing property limits the likelihood of an expansion of the restaurant facilities, an increased interest in the property by the Airport to limit expansion, doesn't appear necessary. If the property ever becomes available for purchase, it is recommended that the Airport fully acquire the property in fee to remove the existing incompatible facilities.

- **Runway 23 RPZ –** The Runway 23 RPZ currently does not have any incompatible land uses within it; however it does include the railroad tracks and an extremely small portion of a manufactured housing community to the east of the railroad tracks. The portion of the RPZ overlying the housing community does not currently have any housing units within the RPZ, and given the small amount of land within the RPZ and how close the RPZ line is to the housing community's property line, it doesn't appear likely that any housing units would be placed into the RPZ in the future.

3.6.c Runway 9/27 – Runway 9/27 is a secondary crosswind runway at the Airport that primarily serves small aircraft. The runway is designed for up to ARC category B-I aircraft. The following lists the design standards for the runway:

- **Runway Length and Width:** Runway 9/27 is 2,800 feet long and 60 feet wide. The length and width of the runway allows it to serve only small aircraft exclusively in crosswind conditions. Land uses to the east and west constrain future expansion of the runway to make it capable for use by larger aircraft.

- **Surface, Strength, and Condition –** Runway 9/27 is a prepared hard surface paved with asphalt and is rated up to 30,000 pounds for aircraft with single wheel main landing gear configurations. A 2007 inspection found the runway to be in "very good" condition with small quantities of cracking observed. The runway was assigned a PCI rating of 89. No future improvements other than routine and preventative maintenance are anticipated to be needed to the runway over the planning period.

- **Runway Safety Area –** Dimensions for the RSA for Runway 9/27 are based on design group "I" aircraft and the visual approach to the runway. Taking these into account, the safety area extends 240 feet beyond each runway end and is 120 feet wide. The existing RSA for Runway 9/27 meets standards, however the safety areas for Runway 9/27 and Runway 5/23 insect at the approach ends of Runway 5 and Runway 9. This intersection of safety areas creates a potential safety concern due to the geometry of the runways and associated taxiways. Alternatives for improving the safety of this intersection are discussed in Chapter 4.

- **Runway Object Free Area –** The ROFA for Runway 9/27 extends 240 feet beyond each runway end and has a width of 400 feet. These dimensions meet standards for runways designed for ARC design group “I” aircraft with visual approaches. No improvements are necessary at this time.

- **Runway Obstacle Free Zone –** The length of the ROFZ for Runway 9/27 extends 200 feet beyond each runway end and has a width of 250 feet. These dimensions meet design standards and no improvements are necessary at this time.

- **Runway Protection Zone –** The RPZs on either end of Runway 9/27 are identical in size due to each having visual approaches and serving aircraft under 12,500 pounds exclusively. The RPZs begin 200 feet past the end of the runway pavement and extend for a length of 1,000 feet. The inner widths of both RPZs are 250 feet with an outer width of 450 feet. The Runway 9 RPZ includes Portage Road but does not have any incompatible land uses such as residences or places of assembly within it at this time. The Runway 27 RPZ includes the railroad tracks along the east side of the Airport but does not have any incompatible land uses within it at this time. Both RPZ’s appear to meet standards and no improvements are necessary at this time.

3.6.d Runway Design Standards Summary – Table 3-12 summarizes the dimensions of the design standards for each runway at the Airport.

Table 3-12
Runway Design Standard Dimensions

Runway/Standard	17	35	5	23	9	27
Length	6,502 ft	6,502 ft	3,438 ft	3,438 ft	2,800 ft	2,800 ft
Width	150 ft	150 ft	100 ft	100 ft	60 ft	60 ft
Surface	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt
Strength						
Single Wheel	85,000 lbs	85,000 lbs	30,000 lbs	30,000 lbs	30,000 lbs	30,000 lbs
Dual Wheel	121,000 lbs	121,000 lbs	45,000 lbs	45,000 lbs	n/a	n/a
Dual Tandem	240,000 lbs	240,000 lbs	60,000 lbs	60,000 lbs	n/a	n/a
PCI Rating	67	67	88	88	89	89
Safety Area						
Beyond Rwy End	1,000 ft	1,000 ft	300 ft	300 ft	240 ft	240 ft
Width	500 ft	500 ft	150 ft	150 ft	120 ft	120 ft
Object Free Area						
Beyond Rwy End	1,000 ft	1,000 ft	300 ft	300 ft	240 ft	240 ft
Width	800 ft	800 ft	500 ft	500 ft	400 ft	400 ft
Obstacle Free Zone						
Beyond Rwy End	200 ft	200 ft	200 ft	200 ft	200 ft	200 ft
Width	400 ft	400 ft	200 ft	200 ft	250 ft	250 ft
Runway Protection Zone						
Beyond Rwy End	1,700 ft	2,500 ft	1,000 ft	1,000 ft	1,000 ft	1,000 ft
Inner Width	500 ft	1,000 ft	500 ft	500 ft	250 ft	250 ft
Outer Width	1,010 ft	1,750 ft	700 ft	700 ft	450 ft	450 ft

Source: Airport Layout Plan

3.7 Taxiway Facilities

Taxiways are defined paths established for the taxiing of aircraft from one part of an airport to another. Since these surfaces are transition pathways between aircraft parking locations and the runway environment, design standards are established to provide wingspan and wingtip clearances. Standards as defined in FAA AC 150/5300-13, *Airport Design*, provide recommended design criteria for taxiway systems.

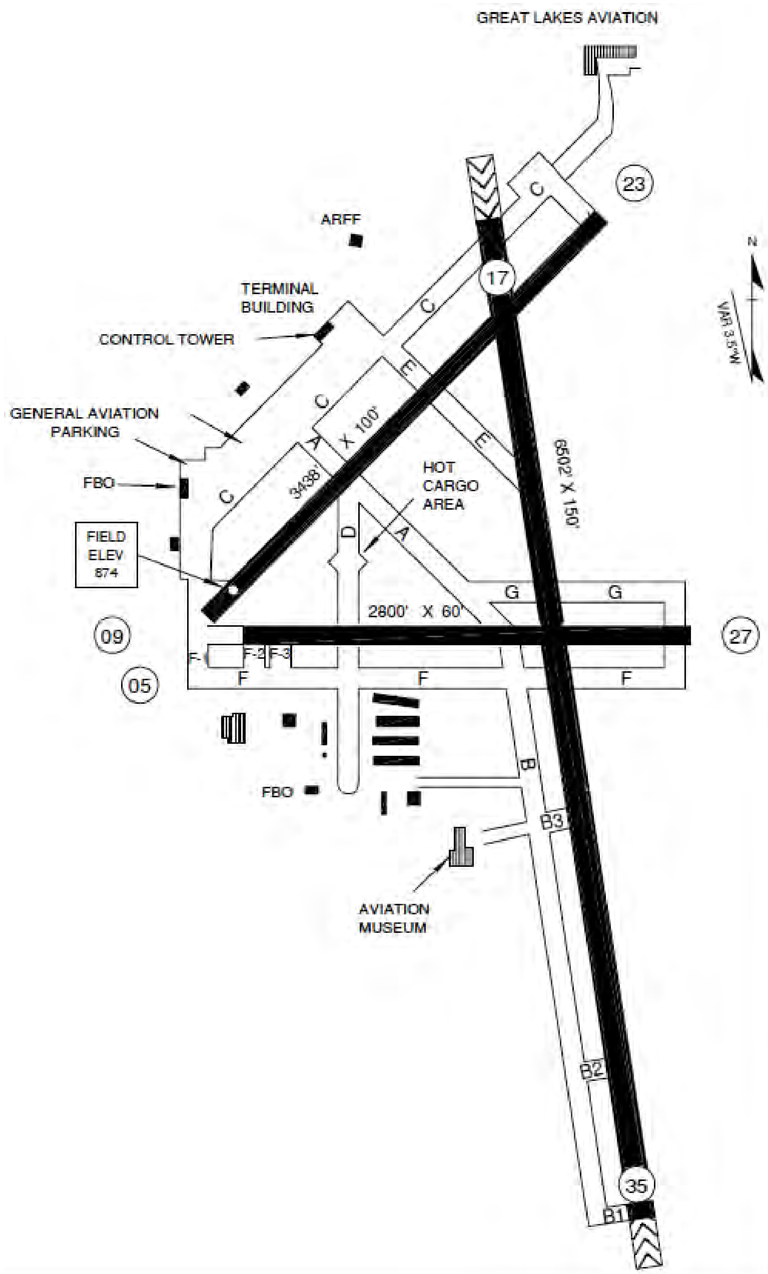
3.7.a Configuration – Taxiway systems are designed for the safe and efficient movement of aircraft to and from the runways to destinations on the airfield. The configuration of the taxiway system should be designed so that it efficiently supports the volume of taxiing aircraft without impacting airfield capacity. The taxiway system should also be designed to provide safe taxi routes that minimize runway crossings, limit use of the runway environment for taxiing operations, and are spaced according to design standards that provide wingtip and wingspan clearances from other airfield surfaces.

A recent taxiway relocation project completed in 2007 brought all taxiways on the airfield up to FAA design standards for separation from the runways. The width of all taxiways also meets FAA design standards as they are compliant with the ARC for the runway each taxiway is designed to serve. The intersection of Runway 5/23 and Runway 927 creates a potential airfield operational safety issue for associated taxiways. The geometry of Taxiway C, F, F1 and the locations of the taxiway holding positions create the potential of an aircraft taxiing and/or departing from the wrong surface. After a pilot receives clearance to proceed past the hold short line from air traffic control, the geometry of runway and taxiway intersections creates the potential for an aircraft to maneuver onto the incorrect surface and depart from the wrong runway. **Figure 3-3** illustrates this intersection along with the entire taxiway configuration at the Airport.

It should be noted that decommissioning Runway 9/27 would decrease the risk of runway incursions. Closure of the runway would eliminate the risk of an aircraft lining up with the wrong runway at the intersection of Runway 9/27 and Runway 5/23. Closure of Runway 9/27 would also eliminate a runway crossing for aircraft taxiing from the north to the south end of Runway 17/35. Recent FAA air traffic control procedural changes require that an aircraft clear the runway safety area environment when crossing a runway before receiving clearance to cross an additional runway. The geometry of the runway and taxiway intersections and safety areas increases the workload for air traffic controllers and complexity of taxiing instructions for aircraft at this airfield location. Decommissioning Runway 9/27 will reduce the potential for runway incursions and reduce air traffic controller workload with little loss to airfield capacity since Runway 9/27 has limited utility due to its short length and the orientation of Runway 5/23 to support the crosswind component.

Future airfield development, including runway extension or relocation, should consider necessary improvements to the taxiway system. Any future runway extension should also plan for the extension of the associated parallel taxiway and construction of additional connector taxiways as necessary. Improvements to the taxiway system should be such that the airfield is able to maintain capacity and continue to accommodate the safe and efficient movement of aircraft.

Figure 3-3
Airfield Taxiway Configuration



Source: Michigan Department of Transportation

3.7.b Width – The width of a taxiway is based on the airplane design group category of the critical design aircraft intended to use the surface. The width of taxiways on an airfield may vary based upon the ADG of the runway they support. At the Airport, taxiways designed to serve ADG III aircraft on Runway 17/35 and ADG II aircraft on Runway 5/23 have a width of 50 feet, meeting design standards. Taxiways that support ADG I aircraft utilizing Runway 9/27 are 35 feet width in length and exceed design standards. No changes are necessary to increase taxiway widths as all meet or exceed design standards at this time.

3.7.c Taxiway Safety Area – Taxiway safety areas are similar to RSAs in that they are designed for the unintended excursion of aircraft from the taxiway surface. Taxiway safety areas must be clear and graded, drained, capable of supporting aircraft, snow and firefighting equipment, and must be free of objects except those necessary because of their function. The length of a taxiway safety area is the same length as the taxiway while the width is based on the ADG of the most demanding type of aircraft designed to use the surface. At the Airport, the width of all taxiway safety areas meet FAA airport design standards for the critical design aircraft for each surface and no improvements are necessary at this time.

3.7.d Taxiway Object Free Area – The taxiway object free area encompasses the taxiway safety area and increases safety to taxiing aircraft by restricting objects above ground. Service roads, parked aircraft, and all above ground objects except those necessary for aircraft air or ground maneuvering purposes cannot be located in a taxiway object free area. The width of a taxiway object free area is based on the most demanding ADG category of aircraft designed to use the surface. The widths of all taxiway object free areas at the Airport meet FAA design standards.

3.8 Aprons

Aprons are prepared, hard surfaces that are designed for aircraft parking, loading and unloading of passengers and cargo, fueling operations, and aircraft maintenance. Aprons should be optimally designed to accommodate a changing mix of transient and parked aircraft. Several factors that influence apron design include types of aircraft anticipated to use the surface, access requirements by ground support equipment, and FAA design standards for safety, obstacle, and visual clearances.

At the Airport, a large apron area of approximately 543,500 square feet serves both commercial service aircraft at the terminal building and transient general aviation aircraft at Duncan Aviation. A majority of this apron area to the northeast is used for commercial service aircraft operations at the terminal building while a smaller portion to the southwest is utilized for transient aircraft at Duncan Aviation. Smaller apron areas supporting a variety of functions are also located through the Airport. These smaller aprons can be found north at the Great Lakes Aviation facility, south in the T-hangar area as well as at the Kalamazoo Aviation History Museum (Air Zoo), and west adjacent to the Duncan Aviation facility.

Future apron space at the Airport will depend on planned development. The new terminal building utilizes existing apron area to the northeast of the former terminal and is capable of supporting commercial service aircraft operations for the foreseeable future. As such, no additional terminal area apron development is anticipated. Any further expansion of the terminal building area may require development of additional apron space in the future.

General aviation apron areas are sufficient to meet existing and anticipated user needs; however, any further development of facilities (such as additional general aviation hangars, service areas, or Fixed Based Operator (FBO) facilities) may require construction of additional apron space.

Any future apron areas should be constructed to support aircraft loading and unloading, and provide sufficient space for ground maneuvering and parking of aircraft.

3.9 Air Traffic Control

Air traffic control at the Airport is provided by the FAA through an air traffic control tower (ATCT) and terminal radar approach control (TRACON) facility. Both operations are currently located in the former terminal building and are responsible for the safe separation of aircraft during different stages of flight. The ATCT is responsible for the safe and efficient movement of aircraft and vehicles on taxiways and runways while directing aircraft within a 4.1 nautical mile radius of the Airport up to an altitude of 3,000 feet mean sea level (MSL). TRACON is responsible for the separation of arrival, departure, and transient aircraft within 40 nautical miles of the airfield up to an altitude of 10,000 feet mean sea level (msl).

The existing ATCT is located on the top of the former terminal building while the TRACON facility is located on the 2nd floor. Development began in 2008 to construct a new ATCT and TRACON facility on the east side of the airfield. The new control tower and approach control facility will accommodate several controllers and is also anticipated to house the approach control operations for Lansing, Grand Rapids, and Muskegon airports. Initial design began in 2009 with construction expected to be completed in 2013.

With construction of this new facility, no improvements are anticipated to the air traffic control infrastructure at the Airport through the planning period. It should be noted that the former terminal building will need to be kept operational through the completion of the new ATCT/TRACON facility, as it will continue to house the operations of the control tower and approach control until the new facility is completed.

3.10 Navigational Aids

Navigational aids (NAVAIDs) help contribute to the safety and operational capacity of an airport. While Chapter 1 inventoried the types of NAVAIDs located at the Airport, this section evaluates these pieces of equipment found on the airfield and provides recommendations for NAVAID development during the planning period.

3.10.a Rotating Beacon – The rotating beacon for the Airport is located on top of the ATCT. The beacon rotates 360 degrees when illuminated and assists pilots in visually identifying the Airport's location during nighttime and other times of reduced visibility. Since the Airport is open for civil use, a green flash followed by a white flash is emitted from the lenses, which indicates it is open for public use.

When air traffic control relocates to its new facility in 2013, the existing tower will be demolished by the FAA. Demolition of the existing tower will require the rotating beacon to be relocated. A new location for the rotating beacon will need to be placed at a height where few objects will be capable of obstructing the light emitted. A designated tower on the airfield may be the most effective way to provide the elevation needed for the beacon light to be minimally affected by obstructions.

3.10.b Wind Indicators – Three wind indicators are located on the airfield and can be found north of Taxiway B2, inside the segmented circle located midfield between Taxiway A and Taxiway D, and east of the intersection of Runway 17/35 and Runway 5/23. All wind indicators are lighted so they can be used at night and during times of reduced visibility. Wind indicators should be located in proximity to each runway end to provide pilots with wind direction and strength information prior to takeoff and when on final approach to landing. The locations of the wind indicators at the Airport are positioned in view of each runway end and no relocation or installation of additional wind indicators is anticipated.

3.10.c Segmented Circle – The segmented circle at the Airport is located between Taxiway A and Taxiway D north of Runway 9/27. Segmented circles may also be equipped with traffic pattern indicators to define right or left hand traffic patterns. The segmented circle at the Airport is not equipped with traffic pattern indicators as this is typically included only at non-towered airports. Since the Airport is equipped with an operational control tower, no improvements are anticipated to be necessary to the segmented circle.

3.10.d MALSR – Runway 35 is equipped with a Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR). A MALSR is installed on runway ends to compliment an instrument landing system (ILS). MALSR lights help pilots to identify the approach end of a runway during times of reduced visibility, such as inclement weather and nighttime conditions. The existing MALSR system meets design and lighting standards.

3.10.e Precision Approach Path Indicator – Precision Approach Path Indicators (PAPIs) are lighted NAVAIDs that guide pilots to the correct approach slope when landing on a runway. The light beams are angled from the PAPI to help the pilot identify the correct approach slope based on the orientation of the red and white lights emitted. PAPIs are installed at the Airport on the approach ends or Runway 17, Runway 35, Runway 5, and Runway 23. All installed PAPIs meet standards and no improvements are anticipated.

3.10.f Runway End Identifier Lights – Runway End Identifier Lights (REILs) are flashing strobe lights located at the end of a runway used to identify the beginning of the threshold. REILs are useful for pilots visually locating the end of a runway at nighttime, or during other times of reduced visibility. At the Airport, REILs are located at the ends of Runway 5, Runway 17, and Runway 23. Installation of REILs at the end of Runway 35 are not necessary due to the ILS equipment installed and are not necessary for Runway 9/27 since both ends of the runway have a visual approach. No improvements to the REIL equipment are anticipated over the planning period.

3.10.g Instrument Landing System – An instrument landing system (ILS) is composed of two different components; a glide slope and a localizer. The glide slope is located near the touchdown point of a runway and emits signals that provide vertical guidance to properly equipped aircraft. A localizer is located past the end of a runway and emits signals that provide horizontal guidance to properly equipped aircraft. Installation of an ILS at a facility allows an airport to maintain capacity during low visibility and inclement weather conditions.

At the Airport, Runway 35 is the only runway equipped with an ILS. Projections forecast that ground based instrumentation for precision approaches such as ILS will be supplemented and eventually replaced by satellite navigation systems. However not all aircraft, particularly many air carrier aircraft, are equipped for GPS approaches and therefore the existing Runway 35 ILS approach and equipment should be maintained for the foreseeable future.

3.10.h Global Positioning System (GPS) – The Global Positioning System (GPS) is a satellite based navigation system that provides location information to properly equipped aircraft. Utilization of GPS for instrumentation runway approaches is increasing as the technology and equipment allow greater safety, reliability, and precision location information. At the Airport, aircraft are able to utilize GPS to perform non-precision instrument approaches to Runway 17, Runway 35, Runway 5, and Runway 23.

It is recommended that the Airport plan for future development that can position it to utilize this technology to its fullest extent. Although the GPS navigation system does not require the installation of ground based equipment (other than a WAAS tower) it is critical for the Airport to maintain clear approaches to runway ends and mitigate incompatible land uses so that the system can continue to be used for approaches and additional GPS approaches can be developed in the future.

3.10.i Very High Frequency Omni-directional Radio Range (VOR) – Very High Frequency Omni-directional Radio Range (VOR) is a ground based NAVAID that uses radio signals to help a pilot determine his course and position. Radio signals transmitted from this equipment allows a pilot to determine his bearing in relation to the location of the VOR. At the Airport, a VOR is located between Taxiway A and Taxiway E east of Runway 5/23. Though VORs do not provide navigational information to the accuracy of GPS, it is recommended that the Airport continue to maintain the VOR located on the airfield as it will continue to be a useful navigational aid.

3.10.j Non-Directional Beacon (NDB) – A non-directional beacon (NDB) also is a piece of ground based navigational equipment that provides an omni-directional signal. This beacon is similar to a VOR in that it allows a pilot to determine an aircraft's bearing based on the distance from the NDB. A NDB is located 6.4 miles south of the Airport near Vicksburg that assists aircraft in lining up for approach to Runway 35. It is recommended that the Airport continue to utilize this NAVAID as another tool for pilots when on approach to Runway 35. Installation of additional NDBs is not anticipated to occur through the planning period.

3.11 Airfield Lighting

Airfield lighting is an important tool that helps to identify movement surfaces at an airport at night or during other times of reduced visibility. The primary goal of airfield lighting is to outline and identify the locations of these surfaces, but it also can help pilots identify distances based on the spacing and color of the lighting. The follow section reviews airfield lighting and identifies recommended areas for improvement.

3.11.a Runway 17/35 – Runway 17/35 is equipped with High Intensity Runway Lights (HIRL). HIRL offers the highest level of illumination intensity and the greatest number of intensity settings. Runways equipped with precision instrument approaches are typically equipped with HIRL systems. Since Runway 35 is equipped with an ILS, no improvements to the runway lighting are necessary.

3.11.b Runway 5/23 – Medium Intensity Runway Lighting (MIRL) is installed on Runway 5/23 and offers variable intensity control similar to that offered by a HIRL. MIRL systems are typically installed on runways with non-precision approaches. Since these types of approaches are found on either end of Runway 5/23, no improvements are recommended to the lighting system. It should be noted that the runway lighting may need to be upgraded to a HIRL system if satellite based precision approaches are developed for Runway 5/23.

3.11.c Runway 9/27 – Runway 9/27 is also equipped with MIRL. Since Runway 9/27 has only visual approaches, the intensity of illumination and variable settings offered by MIRL systems exceed lighting requirements for visual runways. No improvements to the runway lighting system are anticipated.

3.11.d Taxiway Lighting – As part of the Taxiway B relocation project in 2007, Medium Intensity Taxiway Lighting (MITL) utilizing light-emitting diode (LED) lights were installed on this section of taxiway. The LED lights offer a greater lifespan and lower energy usage than standard taxiway lighting, which reduces airfield maintenance and operation expenses. It is recommended that the Airport consider replacing traditional incandescent taxiway lighting, when feasible, with LED taxiway lighting when planning for future development. Though costs incurred to install LED lighting may be greater than installation of incandescent lighting, over the lifetime of the lights the Airport may be able to regain the cost of installing the new fixtures through the reduced energy usage.

3.12 Terminal Building

In April of 2011, the Airport finished construction of the new terminal and transferred all commercial airline operations from the former building. Since a comprehensive planning effort had been undertaken by the Airport in collaboration with federal, State, and local officials and the surrounding community, recommendations for the new building will not be discussed in this section. Though airline service has been transferred to the new terminal, the former building will need to be maintained for air traffic control and air cargo operations. Air traffic control operations will continue at the former terminal until the new ATCT and TRACON facility is completed in 2013 while freight forwarding will continue in the former terminal building indefinitely.

When the ATCT and TRACON facility is relocated, several options are available for use of the former building. With its access to the main apron, the building could be leased for aeronautical related use, such as an air cargo operation or fixed based operator (FBO). The building could also be leased to non-aeronautical related businesses and converted into a business park. Demolition is another option for the portion of the building not in use, as this would open up an available development area. Available space in proximity to the new terminal opens up opportunities for the development of an on-airport car rental service center or additional long and short term parking. Chapter 4 discusses in more detail alternatives for future use of this building.

3.13 Aircraft Rescue and Fire Fighting (ARFF)

Airports certified under FAR Part 139 are required to provide Aircraft Rescue and Fire Fighting (ARFF) emergency response in the event of an aircraft incident. Several factors contribute to determining an airport's ARFF Index, or classification of type of response. The ARFF Index is determined by the length and average daily departures of air carrier aircraft. The ARFF Index at the Airport is Index B, which allows the Airport the capability to meet the emergency response requirements for air carrier aircraft up to 126 feet in length. As an ARFF Index B facility, the Airport is required to have one or two ARFF vehicles capable of carrying 500 pounds of sodium-based dry chemical or halon, 1,500 gallons of water, and a commensurate quantity of foam for foam production. The Airport is equipped with two ARFF fire trucks that meet this requirement and no recommendations for additional equipment are necessary at this time.

In evaluating the future fleet of air carrier aircraft anticipated to operate at the Airport, there are some regional and narrow-body aircraft with lengths longer than 126 feet. Some of these aircraft include the Embraer 195 (126.8 feet), CRJ-1000 (128 feet), Boeing 737-800 (129.5 feet), and the Boeing 737-900 (138 feet). While commercial aircraft over 126 feet in length do not currently operate at the Airport, and therefore do not require an increase in the ARFF index, future ARFF facilities should plan to support Index C equipment should an upgrade in the ARFF index be necessary.

As of this Master Plan update, the Airport was seeking to update its ARFF facility by planning construction of a consolidated ARFF and Snow Removal Equipment (SRE) building. The existing ARFF building, located north of the new terminal, needs upgrades such as additional space in the equipment bays to accommodate larger next generation ARFF apparatus, improved crew facilities that provide additional work and living space for fire fighters, and a centralized location for the ARFF and maintenance departments.

The location of this building should provide direct access to the airfield for the ARFF, SRE, and other maintenance equipment. The location of the building should also allow ARFF equipment to meet response performance criteria that, within three minutes from the time of an alarm, one vehicle must reach the midpoint of the furthest runway serving air carrier aircraft. The consolidated ARFF/SRE building should also incorporate efficiency and ease of access to the landside for large vehicles providing equipment or material deliveries.

3.14 Airport Maintenance/Storage Facilities

Three buildings located east of the T-hangar area provide storage areas for Airport maintenance equipment and materials. A large building with bays capable of housing SRE and other maintenance equipment is located to the north while two smaller buildings providing alternative locations for equipment and materials is located south. Due to limited space available in each building, maintenance equipment such as snow plows, barricades, and smaller vehicles such as pickup trucks and tractors, occasionally need to be located outside to provide additional space in the buildings.

To provide additional space for equipment, improved offices and work stations for maintenance personnel, and a centralized location for all equipment, the Airport is seeking to construct a consolidated ARFF/SRE building. As mentioned in the previous section, the location of this building should provide direct access to the airfield while providing sufficient space for the maneuvering of equipment and deliveries of materials. With this building also housing ARFF equipment, it is important that the location not only meet the needs of snow removal and other maintenance equipment, but also meet requirements for ARFF response. The size of the building should also allow adequate space to house all ARFF, SRE, and other maintenance vehicles, storage of ARFF, SRE, and maintenance equipment and raw materials, and provide sufficient area for maintenance and repair to be conducted.

3.15 General Aviation Facilities

Three locations on the Airport provide facilities for general aviation (GA). To the north, Great Lakes Aviation, LLC provides a flight training school and aircraft maintenance. South of Taxiway F, several hangar buildings are located that provide storage areas for personal and business aircraft, repair, inspection, and maintenance areas, and restoration facilities for historic aircraft at the Air Zoo. A self-serve fueling facility and restroom are also located in this area providing FBO services to pilots. To the west Duncan Aviation provides Fixed Based Operator (FBO) services for GA users such as fueling, maintenance, a waiting area for passengers, and a pilot's lounge. Riley Aviation also operates a hangar to the west that is utilized for their aircraft charter operation.

In reviewing the general aviation facilities, no improvements are necessary to the Airport's FBO operations at this time. The Airport provides adequate services that meet the needs of general aviation users with the FBO facility operated by Duncan Aviation, aircraft charter services provided by Duncan and Riley Aviation, the maintenance, repair, and flight training provided by Duncan Aviation, Great Lakes Aviation, and Kalamazoo Aviation, and fueling provided by the Kalamazoo Pilots Association and Duncan Aviation. No additional recommendations to FBO services are necessary.

Excluding one T-hangar slated for removal, the current ALP shows that there are 84 T-hangar units, and approximately 20,668 square feet (SF) of executive hangar space. There are 12 hangars that are used by the FBOs or Western Michigan University. There are also 15 aircraft tiedowns on the apron on the west side of the airfield that are owned by the County, and are used by both based aircraft and transient aircraft. According to the FAA Terminal Area Forecasts (TAF), there were 149 based aircraft at Kalamazoo/Battle Creek International Airport in 2009.

Although not all hangar storage spaces and aircraft tiedowns currently operate at full capacity, it is anticipated that additional facilities will be required as projected levels of activity increase over the planning period.

3.15.a Aircraft Tiedown Requirements – As previously noted aircraft tiedowns are used by both based and transient aircraft. Per FAA AC *150/5300-13, Airport Design, Appendix 5*, the average number of projected daily general aviation operations in the peak month is increased by ten percent (10%) to obtain the number of operations on a typical busy day. As presented in Chapter 2, projections of annual general aviation operations are projected to increase by a 1.08 percent CAGR. It is anticipated that the average number general aviation operations in the peak month will increase at the same rate as annual operations, and that required aircraft tiedown demand will coincide with this rate as well. Average peak day operations in the peak month, as well as required tiedowns are shown in **Table 3-13**. As shown in the table, the number of current aircraft tiedowns appears capable of accommodating demand through the projection period, though the Airport should continue to monitor use and changes in demand in the future.

3.15.b Based Aircraft Storage Hangars – Most based aircraft at the Airport are stored in hangars. This is likely to continue in the future, as Kalamazoo receives approximately 20 inches of rainfall and nearly 70 inches of snowfall annually.

Based aircraft fleet mix projections are described in Chapter 2 and are also shown in **Table 3-14**. According to the table it is anticipated that there will be 156 based aircraft at the Airport in 2015, 162 in 2020, 171 in 2025, and 181 in 2030. Hangar storage requirements are contingent not only on the number of projected based aircraft, but on the type and size of the aircraft as well.

Table 3-13
Required Aircraft Tiedowns

Year	Average Day Peak Month GA Operations	Aircraft Tiedowns Required	Current Aircraft Tiedowns	Additional Tiedowns Required
2009	161	10	15	-
2015	179	11	15	-
2020	196	12	15	-
2025	214	13	15	-
2030	234	15	15	-

Source: FAA ATADS Database, Kalamazoo/Battle Creek International Airport. Mead and Hunt

Table 3-14
Based Aircraft Projections

Year	Single Engine	Multi Engine	Jet	Helicopter	Other	Total
Historical:						
1995	110	40	5	2	0	157
1996	110	40	5	2	0	157
1997	110	40	5	2	0	157
1998	110	40	5	2	0	157
1999	101	28	6	0	1	136
2000	101	28	6	0	1	136
2001	93	13	5	0	0	111
2002	91	17	7	0	0	115
2003	91	17	7	0	0	115
2004	111	10	5	1	1	128
2005	131	12	5	0	0	148
2006	131	12	5	0	0	148
2007	131	12	5	0	0	148
2008	131	12	5	0	0	148
2009	132	12	5	0	0	149
Projected:						
2015	139	12	5	0	0	156
2020	141	15	6	0	0	162
2025	147	15	9	0	0	171
2030	154	16	11	0	0	181

Notes: Numbers may not add due to rounding
Sources: Historical Based Aircraft – FAA Terminal Area Forecasts
Projections: Mead & Hunt, Inc.

A list of aircraft that typically operate or are anticipated to operate at the Airport is shown in **Table 3-15**. The dimensional criteria of these aircraft will be used to calculate future apron and hangar demand.

Table 3-15
Typical Operating Aircraft

Aircraft Category	Aircraft Type	Length (ft.)	Wingspan (ft.)	Aircraft (L x W)	Hangar Space (SF)*
Jet	Raytheon Hawker 800	50.8	47.0	2,388	3,466
Jet	Raytheon Premier 390	45.3	44.5	2,016	3,014
Jet	Citation X	72.2	63.9	4,613	6,443
Jet	Beechjet 400	48.4	43.5	2,106	3,393
Jet	Cessna Citation III	55.5	53.5	2,969	4,160
Jet	Dassault Falcon 50	61.9	61.9	3,832	5,170
Jet	***Average***	***55.7***	***52.4***	***2,493***	***4,274***
Multi	King Air 300	43.8	54.5	2,389	3,795
Multi	Cessna 310	27.0	35.8	966	1,694
Multi	Cessna 340	34.3	28.1	964	1,650
Multi	***Average***	***35.0***	***39.5***	***1,440***	***2,380***
Single	Cessna 206	35.8	28.3	1,012	1,944
Single	Cessna Centurion	28.2	36.8	1,035	2,018
Single	Piper Cherokee	24.3	30.0	728	1,570
Single	Piper Comanche	25.0	36.0	900	1,840
Single	Beechcraft Bonanza	25.2	32.9	830	1,510
Single	***Average***	***27.7***	***32.8***	***901***	***1,776***

Sources: www.airliners.net, Mead and Hunt

*Required hangar space assumes a five foot buffer for the aircraft's wings and tail, and a ten foot buffer for the nose.

Calculations to determine additional aircraft storage hangar needs are based on the following assumptions and planning ratios:

- T-hangar spaces are assumed to be of standard size (1,400 SF recommended per aircraft)
- Corporate hangars are sized to accommodate the average space required by aircraft category as shown in Table 3-15; 1,800 SF per single engine aircraft, 2,400 SF per multi-engine aircraft, and 4,300 SF per jet/turboprop aircraft. These dimensions include a five-foot buffer for the aircraft's wings and tail, and a 10 foot buffer for the nose.

Calculations also include the following planning ratios as to the type of storage facility to plan for based aircraft type:

- Single engine: 90 percent (90%) are stored in a hangar; of those aircraft 95 percent (95%) are stored in T-hangars/shelter units and 5 percent are stored in corporate hangars.
- Multi-engine: 95 percent (95%) are stored in a hangar; of those aircraft 40 percent (40%) are stored in T-hangars/shelter units and 60 percent (60%) are stored in corporate hangars
- Jet/Turboprop: 100 percent (100%) are stored in corporate hangars

It should be noted, that some based aircraft may be stored at FBOs, and required hangar storage projections are solely for spatial planning purposes only. Hangar demand projections are shown in **Table 3-16**.

Table 3-16
Aircraft Hangar Demand

		Projected Demand			
	Factor	2015	2020	2025	2030
Increase Based Aircraft Hangar Demand					
Single Engine	90%	6	8	13	20
Multi-Engine	95%	0	2	3	4
Jet/Turboprop	100%	0	1	4	6
Aircraft Storage					
T-Hangar Units					
Single Engine	95%	6	8	13	19
Multi-Engine	40%	0	1	1	2
Additional T-Hangar Unit Demand		6	9	14	20
Corporate Hangars					
Single Engine	5%	0	0	1	1
Multi-Engine	60%	0	1	2	2
Jet/Turboprop	100%	0	1	4	6
Additional Corporate Hangar Space Demand (sf)		**0**	**10,200**	**36,800**	**51,400**

Sources: FAA Advisory Circular 150/5300-13, *Airport Design,* and Mead & Hunt.

There is a limited amount of land available on existing property for construction of additional hangars and GA facilities. Acquisition of land near the Air Zoo extending south towards Romence Road and west towards Portage Road could provide a large development area for a variety of aviation facilities. The proximity of this land to the airfield makes it an ideal alternative area for aeronautical related development. It is recommended that the feasibility of acquiring this land be evaluated when considering development locations for future GA and other facilities.

Additional development areas may also be available should Runway 9/27 be decommissioned. Closure of the runway would open up land on existing Airport property that would be available for potential GA facilities both east and west of Runway 17/35. Alternatives reviewing potential GA development areas are presented in Chapter 4.

3.16 Airport Tenants – Through-the-Fence Operations

Three tenants at the Airport conduct through-the-fence operations. Through-the-fence operations include those where a business or individual has direct access to an airfield that is not a part of airport property. These types of operations are strongly discouraged by the FAA as they may lead to complications and possible violations of grant assurances.

Though an airport is not obligated to provide this type of access to the airfield, the FAA recommends that agreements be entered with tenants that conduct through-the-fence operations. The Airport, in accordance with FAA recommendations, has agreements with the three tenants that conduct through the fence operations (Hinman Company, Kalamazoo Aviation History Museum, and AZO, LLC). All contribute to the economy of the Airport and provide valuable services to users and other tenants.

Blocking access to the airfield for these tenants is not recommended and acquisition of these properties may not be feasible in the near term. To allow these operations to continue, it is recommended that the Airport continue to honor existing agreements with tenants that meets guidelines set forth in FAA AC 150/5190-7, *Minimum Standards for Commercial Aeronautical Activities.* In this AC, guidelines are provided that say agreements should specify what specific rights of access are granted, any payment provisions for airfield access, default and termination provisions, insurance and indemnity provisions, and include a statement that access is subordinate to grant assurances and federal obligations by the Airport. In the long-term it is recommended that the Airport identify these facilities for acquisition.

3.17 Automobile Parking

Automobile parking is currently provided in a number of locations at the Airport. The following discussion addresses current automobile parking facilities and future parking requirements at the Airport. This analysis has been conducted for public auto parking (short- and long-term), rental car parking, and employee parking.

3.17.a Public Auto Parking – Public parking is located to the west of the terminal building with two distinct public parking lots. The short-term lot has 77 spaces while the long-term lot has 1,322 spaces.

The Airport is generally operated as a spoke airport by air carriers and is characterized by a high percentage of originating passengers with very few, if any connecting passengers. The use of the private automobile is anticipated to continue as the primary means of the getting to the Airport for most originating passengers. As a result, the facility requirements of public parking at the Airport will remain closely associated with the level of enplaning passengers.

In 2008 and 2009, March was the peak month in terms of occupancy within the Airport's public parking lots. **Table 3-17** summarizes the automobile parking requirements for the terminal area, based upon the peak number of spaces occupied during the month of March in relation to enplanements. It is assumed that the auto parking requirements will increase proportionally with the passenger enplanements. General planning standards dictate that parking lots be considered at capacity when they are 80 percent (80%) full, since anything beyond that requires drivers to spend significant amounts of time circulating through parking lots in search of an open space.

As shown in **Table 3-17**, existing public long-term parking is anticipated to be adequate until enplanements surpass approximately 180,000, projected for 2025 under the baseline enplanement projections. By the year 2030, at nearly 210,000 enplanements, there is projected to be a need for 162 additional public parking spaces.

Table 3-17
Long-Term Public Parking Requirements

Year	Enplanements	Peak Spaces Occupied	Spaces per 1,000 Enpl	Parking Spaces Required	Existing Long-Term Lot Spaces	Additional Spaces Required/(Surplus)
Historical						
2008	166,986	948	5.6771	1,185	1,322	(137)
2009	139,712	717	5.1320	896	1,322	(426)
Projected						
2015	144,623	821	5.6771	1,026	1,322	(296)
2020	164,286	933	5.6771	1,166	1,322	(156)
2025	185,862	1,055	5.6771	1,319	1,322	(3)
2030	209,100	1,187	5.6771	1,484	1,322	162

Source: Mead & Hunt, Inc.

Short-term public parking demand is driven by the number of departing and arriving passengers in a peak period, as people are picked up and dropped off. The parking management company notes that the 77 space short-term lot is typically 30 to 40 percent (30-40%) full; however it is 90 percent (90%) full when a Direct Air narrow body charter is arriving or departing. Since the peak period is driven by the narrow body aircraft departures, and an increase in this size of aircraft is not projected, the short-term parking lot appears adequate through the planning period. Occasional peaks in short-term parking demand can be accommodated by the long-term lot, if the short-term lot fills to capacity. Additionally, the layout of the Airport's public parking lots allows the Airport to adjust boundaries between short-term and long-term very easily. The Airport should continue to monitor capacity and parking trends to determine if an adjustment between the short-term and long-term parking lots is necessary.

3.17.b Rental Car Parking – Rental car parking is located to the northwest of the terminal across from the entrance drive and contains 168 spaces. There are currently three primary rental car parent companies operating six rental car agency national brands at the Airport. Facility surveys were provided to the three vendors and returned by each of them. **Table 3-18** summarizes the results of the surveys regarding the number of ready/return parking spaces and long-term storage spaces required both currently and in the long-term (2020).

Table 3-18
Rental Car Parking Requirements

	Current Need			Future Requirements (2020)		
	Ready/Return Spaces	Long-term Storage Spaces	Total Spaces	Ready/Return Spaces	Long-term Storage Spaces	Total Spaces
Vendor 1	70	0	70	90	0	90
Vendor 2	40	50	90	60	75	135
Vendor 3	54	30	84	81	45	126
Total	**164**	**80**	**244**	**231**	**120**	**351**

Source: Rental car vendors

As seen in the table above, one of the vendors expressed a desire to maintain all of their parking needs within the ready/return area. At regional airports such as Kalamazoo/Battle Creek International Airport, it is typical to provide a “close to the terminal” ready/return lot and a separate long-term storage area that the vendors shuttle cars to and from. The more convenient the storage and service areas can be, the more efficient the rental car vendors operations can be.

The existing 168 rental car spaces appears adequate for the existing ready/return requirements, but does not accommodate the long-term storage or service area needs of the rental car vendors. All of the vendors currently have off-airport service and storage facilities. The rental car vendors expressed a strong desire for a shared rental car service facility, commonly referred to as a quick turn-around (QTA) facility. Being able to service vehicles in much closer proximity to the ready/return lot would increase the efficiency of their operations, as would being able to provide for some or all of the long-term storage parking spaces. Development options addressing the need for a QTA and additional rental car parking are presented in Chapter 4.

3.17.c Employee Parking – The employee parking lot is located south of the terminal building and currently has 110 spaces. According to discussions with Airport management it is approximately 70 percent (70%) full during shift change times. **Table 3-19** provides an estimate of the employee parking spaces required, assuming that the required number of spaces increases proportionally to passenger enplanements. As shown in **Table 3-19**, there is a need for approximately 115 employee spaces in 2030. Development options addressing the need for additional employee parking spaces are presented in Chapter 4.

Table 3-19
Employee Parking Requirements

Year	Enplanements	Employee Spaces Occupied	Spaces per 1,000 Enpl	Existing Employee Lot Spaces	Additional Spaces Required/(Surplus)
Historical					
2009	139,712	77	0.5511	110	(33)
Projected					
2015	144,623	80	0.5511	110	(30)
2020	164,286	91	0.5511	110	(19)
2025	185,862	102	0.5511	110	(8)
2030	209,100	115	0.5511	110	5

Source: Mead & Hunt, Inc.

It is recommended that that Airport position itself to address additional parking needs in the future. This is recommended due to the limited room for growth that surrounds the terminal area. Businesses located north on Fairfield Road and west on Portage Road constrain construction of additional surface parking areas. Construction of a parking structure or utilization of land available with removal of the former terminal building are possible alternatives should additional parking needs present during the long term. All parking alternatives are examined in Chapter 4.

3.18 Summary

Recent construction and planning initiatives undertaken by the Airport positions it well to meet future needs. After evaluation of demand capacity and facility requirements, the following summarizes the recommendations provided in this Chapter:

- **Wind Coverage –** Runway 17/35 and Runway 5/23 provide 96.8 percent (96.8%) wind coverage during all weather conditions in a 10.5 knot crosswind. Therefore, it appears feasible to decommission Runway 9/27.

- **Instrument Approaches –** The Airport should continue to maintain clear approaches to all runway ends in anticipation of development of future satellite based instrument approaches. Obstructions found penetrating approach surfaces should be mitigated. Prevention of surrounding incompatible land use also will maintain safety for the Airport as well as the surrounding land owners, and also position the Airport well for development of future instrument approach procedures. With the improved minimums being offered by GPS approaches it is recommended that the Airport seek to enhance the Runway 17 approach minimums down to ¾ of a mile from their current 1-mile, to improve the all weather capability of the Airport’s air carrier runway.

- **Runway Length Needs –** It is recommended that planning occur to evaluate alternatives for extending the length of Runway 17/35. Increasing the distance would better provide for the runway length needs of existing and future users and position the Airport well to continue serving the Southwest Michigan community.

- **Taxiway Configuration –** The geometry of taxiways and runways at the intersection of Runway 5/23 and Runway 9/27 have the potential to be an airfield safety issue. The geometry of these intersections may increase the risk of a runway incursion or aircraft departing from the wrong runway to occur. It is recommended that the intersections of runways and taxiways at this location be reviewed to decrease any potential safety risk.

- **Former Terminal Building –** The former terminal building will need to be maintained until the new ATCT and TRACON facility is completed in 2013. After 2013, it is recommended the building be converted for another use or demolished.

- **ARFF/SRE Building Location –** Construction of a consolidated ARFF/SRE building should be located with access to the airfield that allows timely ARFF and snow removal response and space to safely and efficiently maneuver equipment. The building should also be adequate in size to store all ARFF and maintenance equipment and provide adequate working areas for personnel.

- **General Aviation Development Areas –** It is recommended that the Airport seek additional areas for GA services and aircraft storage. Existing demand illustrated at the Airport identifies a need for additional development areas. Available land southwest of existing Airport property may need to be acquired to meet this need.

- **Through-the-Fence Operations –** A review of existing through-the-fence operations is recommended to avoid possible complications with FAA grant assurances. The Airport should continue to honor existing agreements with tenants that address rights provisions, grant assurances, and federal obligations.

- **Parking – I**t is recommended the Airport evaluate alternatives for increasing public parking, rental car parking and servicing, and employee parking in the terminal area to accommodate current and projected needs.

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Chapter 4
Alternative Analysis

4 Alternatives Analysis

Review of facility requirements in the previous chapter helped identify planning and construction initiatives that may be necessary for the Kalamazoo/Battle Creek International Airport (Airport) to continue to meet user demands through 2030. Identification of future growth and development opportunities provides a basis to evaluate development options to address how these facility requirements will be met. This Chapter seeks to evaluate feasible development alternatives that will allow the Airport to meet anticipated user needs based upon review of demand projections, capacity analyses, and facility requirements. Through the process of comparing the merits and deficiencies of each, a preferred development alternative will be selected based upon the most feasible and prudent course of action towards meeting future facility needs.

The analyses of alternatives and recommended development options as presented in this Chapter are organized into the following sections based upon facility requirements that were identified in Chapter 3:

4.1 Methodology and Evaluation Criteria
4.2 Airfield Wind Coverage
4.3 Runway Length Needs
4.4 Instrument Approaches
4.5 Airfield Taxiway Configuration
4.6 Aircraft Rescue and Fire Fighting/Snow Removal Equipment Building
4.7 General Aviation Development Areas
4.8 Through the Fence Operations
4.9 Use of the Former Terminal Building
4.10 Parking
4.11 Summary

Improvements suggested to the before-mentioned infrastructure components are intended to enhance safety, increase operational efficiency, upgrade existing conditions, and further develop the Airport towards meeting the air transportation requirements of the Southwest Michigan region. The following summarizes these recommended development initiatives for airside and landside elements for their continued adequacy towards meeting projected capacity and demand:

- **Airfield Wind Coverage –** The ability of Runway 17/35 and Runway 5/23 to meet the FAA's recommended wind coverage during Visual Flight Rules (VFR) all weather conditions was reviewed to determine the necessity of Runway 9/27. At a 10.5 knot crosswind component, Runways 17/35 and 5/23 provide wind coverage 96.8 percent (96.8%) of the time during a 10.5 knot crosswind in all weather conditions. In an effort to reduce airfield maintenance costs, it is recommended Runway 9/27 be decommissioned.

- **Runway Length Needs –** The existing length of Runway 17/35 was reviewed to determine its adequacy towards meeting the takeoff and landing distance requirements of existing and anticipated aircraft expected to operate at the Airport throughout the planning period. It is recommended that alternatives for additional runway length be developed as the existing runway length constrains the operations of current and future aircraft and limits the Airport's ability to serve the commercial air transportation needs of the region.

- **Instrument Approaches –** In preserving existing runway approaches and positioning the Airport for development of more precise satellite-based instrument approaches, it is recommended that continued obstruction mitigation occur. Positioning the Airport to accommodate a future satellite-based instrument approach to Runway 17 will increase capacity in limited visibility conditions and inclement weather.

- **Airfield Taxiway Configuration –** The geometry of taxiway and runway surfaces at the intersection of Runway 5/23 and Runway 9/27 is a potential airfield safety issue, increasing the risk of an aircraft maneuvering onto the surface. It is recommended taxiways at this intersection be realigned to increase safety and reduce the potential for a loss in airfield familiarity.

- **Aircraft Rescue and Fire Fighting / Snow Removal Equipment Building –** Improvements to the existing Aircraft Rescue and Fire Fighting (ARFF) building and three structures that house snow removal and other maintenance equipment were determined to be not feasible when considering the construction of a consolidated building for these airfield services. It is recommended an adequate location be identified that meets ARFF emergency response requirements while providing sufficient space for the storage of all snow removal and other maintenance equipment.

- **General Aviation Development Areas –** Existing Airport property limits constrain future general aviation development opportunities. It is recommended that available land to the southwest of Airport property be analyzed for potential to accommodate future general aviation needs.

- **Through the Fence Operations –** Through the fence operations are those that provide private property owners direct access to the airfield environment. The FAA strongly discourages this form of airfield access as it may lead to complications with grant assurances. Though the Airport has a cooperative relationship with these tenants, it is recommended agreements be reviewed to address rights, grant assurances, security, and federal obligations.

- **Use of the Former Terminal Building –** After the air traffic control tower and approach control operations are relocated to their new facility in 2013, it is recommended that use of the former terminal be evaluated to determine the most effective use of this structure and its associated area of land.

- **Parking –** Review of forecasted aviation activities identified a need for additional employee, public, and rental car parking. Though the capacity of existing lots are anticipated to meet short- and medium-term demand projections, it is recommended the Airport begin planning to expand parking capacity as several constraints surrounding the terminal area limit available room for growth. In evaluating parking expansion options, consideration should be given to other needed terminal area improvements, most notably a consolidated rental car quick turn around (QTA) facility.

4.1 Methodology and Evaluation Criteria

The methodology for reviewing each alternative centered on operational, economic, and environmental factors that evaluated the advantages and disadvantages for each proposed infrastructure improvement. Analysis of these justifications will help identify a preferred course of action to effectively guide Airport development to meet user requirements. Each alternative presented in this chapter was reviewed by the following factors:

- **Operational Factors –** Alternatives were evaluated to determine ability in accommodating future demand, such as aircraft operations, enplaned passengers, and vehicle parking. These evaluations help identify deficiencies in such areas as aircraft delay, airfield circulation, convenience, and efficiency.

- **Economic Factors** – The development and operational costs associated with each proposed development were reviewed based upon planning cost estimates, anticipated costs incurred, and existing operating expenses. These estimates provided a general indication of development costs and a basis for comparing cost effectiveness.

- **Environmental Factors –** Key factors such as noise, air quality, water quality, scenic oversight, land use impacts, city and county zoning, and social impacts were reviewed. Evaluation of these factors contributed towards identification of alternatives that minimize impact to the surrounding environment.

- **Implementation Feasibility –** Tangible and intangible factors were analyzed that could affect the Airport's ability to implement an alternative. These include such items as constraints, laws, regulations, design standards, airfield configuration, and internal and public policies.

- **Summary –** A summary is provided at the end of each alternative analysis to identify the advantages and disadvantages of the proposed development option and its ability to adequately meet user needs throughout the planning period. This provides a quick reference point in comparing the advantages and disadvantages of each proposed development option.

It should be noted that for some facility requirements, there are several alternatives that have been developed for consideration while others may have a single, logical development path outlined. The following sections present descriptions of Airport infrastructure needs followed by logical and feasible improvement scenarios that weigh advantages and disadvantages based on the evaluation criteria. At the end of each section, a preferred alternative recommending the most favorable development option is identified that maximizes the long-term growth capabilities of the Airport to sufficiently meet anticipated user demand.

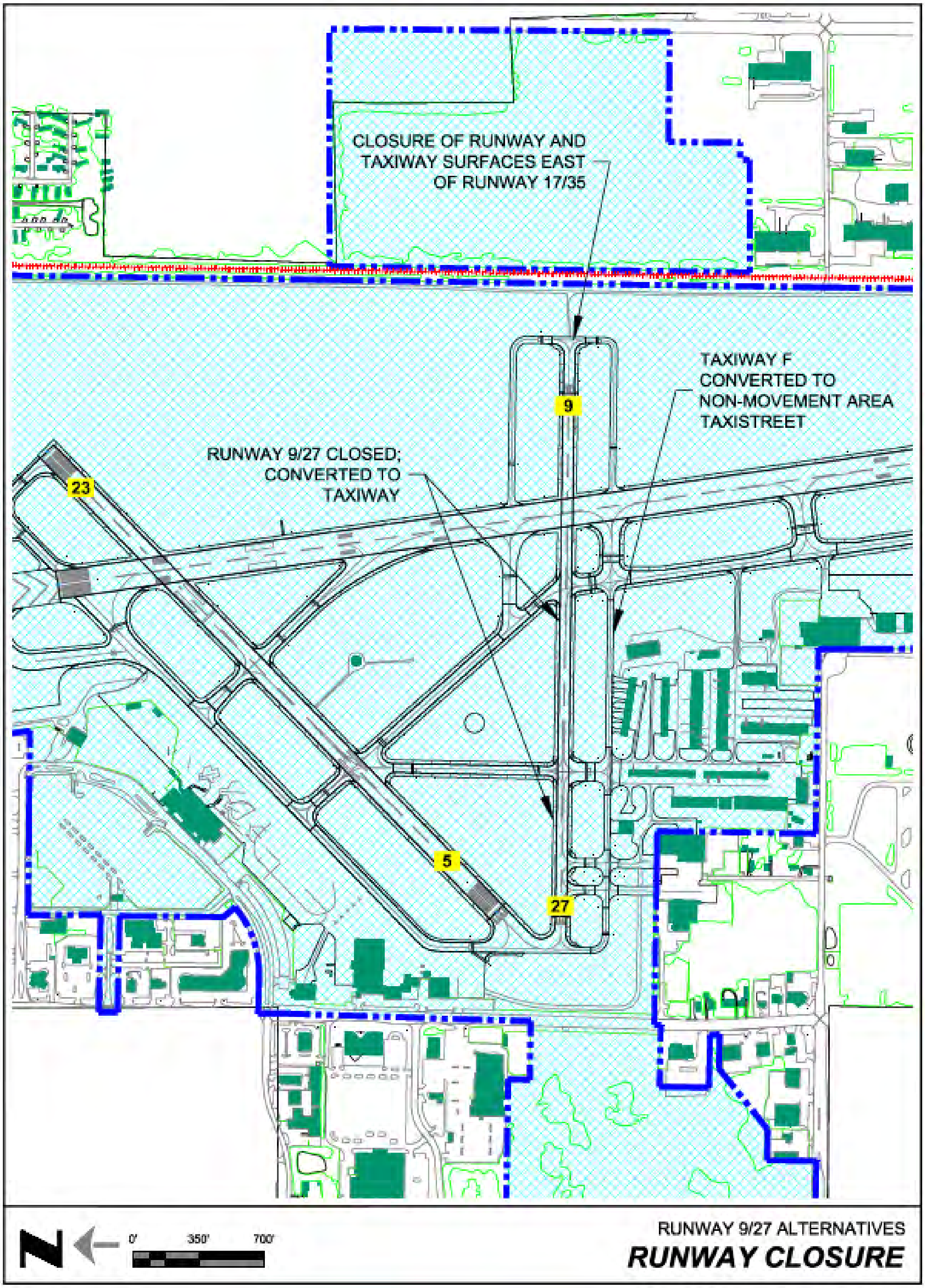
4.2 Airfield Wind Coverage

Since aircraft operators prefer to conduct landing and takeoff operations into the wind, as this increases airflow and provides maximum lift, the orientation of runways at an airport is typically arranged in a configuration that achieves maximum wind coverage for local prevailing and crosswind conditions. The Federal Aviation Administration (FAA) recommends airports have a runway orientation that achieves 95 percent (95%) wind coverage for all local wind conditions.

At the Airport, three runways provide 99.7 percent (99.7%) coverage in all weather conditions at a 10.5 knot crosswind component, the maximum acceptable for most small, light aircraft that are impacted in these conditions. As Airport Improvement Program (AIP) funding is limited to a single instrument runway unless the need for additional runways can be justified, the adequacy of Runways 17/35 and 5/23 in meeting recommended wind coverage was evaluated to determine the necessity of Runway 9/27.

4.2.a Alternative 1 – Closure of Runway 9/27 – A single, logical alternative was developed in addressing the necessity of Runway 9/27 that proposes to decommission the runway and convert the surface into a taxiway. This proposal, identified as Alternative 1, would also convert Taxiway F west of Taxiway B into a non-movement area taxistreet while the sections of Runway 9/27, Taxiway F, and Taxiway G east of Runway 17/35 would be decommissioned and used for non-aeronautical related purposes. **Figure 4-1** illustrates Alternative 1.

Figure 4-1
Alternative 1 – Runway 9/27 Decommission



Source: Mead & Hunt, Inc.

- **Operational Factors –** Closure of Runway 9/27 would not impact the Airport's ability to achieve 95 percent (95%) wind coverage. Based on analyses conducted when reviewing facility requirements, Runways 17/35 and 5/23 achieve 96.8 percent (96.8%) wind coverage in all weather conditions at a 10.5 knot crosswind component. Under VFR meteorological conditions, Runways 17/35 and 5/23 achieve 96.9 percent (96.9%) wind coverage at a 10.5 knot crosswind component while 96.1 percent (96.1%) is achieved in Instrument Flight Rule (IFR) meteorological conditions. As such, the orientation of Runway 9/27 is not necessary for the Airport to achieve recommended wind coverage.

  Decommissioning Runway 9/27 would decrease risk associated with runway incursions and increase the capacity of the airfield. Closure of the runway would eliminate the risk of an aircraft lining up with the wrong runway at the intersection of Runway 9/27 and Runway 5/23. Closure of Runway 9/27 would also eliminate the current runway crossing for aircraft transitioning between Taxiway A and B. Recent FAA air traffic control procedural changes require aircraft to stop and hold short of all runways, regardless of frequency or use. Decommissioning of the runway would reduce this existing taxiing delay.

  No changes to the Airport's throughput capacity, or rate at which aircraft can land and takeoff, would occur with closure of Runway 9/27 as the existing airfield arrangement does not support simultaneous aircraft operations. The existing airfield configuration requires operations to be clear on all runways before a surface is cleared for an aircraft arrival or departure.

- **Economic Factors –** Cost to implement this alternative would be relatively minimal as no significant changes are required to existing infrastructure. Minimal expenses incurred would be associated with such items as the removal of runway surface pavement markings, application of taxiway surface pavement markings, conversion of runway colored edge lighting to taxiway colored edge lighting, and updating airfield location and directional signage. Additional cost may occur if Runway 9/27, Taxiway F, and Taxiway G surfaces east of Runway 17/35 are to be removed. Future development opportunities on the east side of the airfield requiring airfield access may govern the necessity of these surfaces.

  A reduction in airfield operational costs is anticipated with conversion of Runway 9/27 into a taxiway. Energy cost savings are anticipated to be experienced with the removal of the runway's Medium Intensity Runway Lighting (MIRL) and installation of more energy efficient light-emitting diode (LED) taxiway edge lighting. Cost savings will also be experienced in the operational budgets associated with pavement maintenance and snow and ice removal. Conversion of the runway into a taxiway will lessen the priority of the surface and level of required attention in pavement maintenance and winter operation plans.

- **Environmental Factors –** No significant environmental impacts are anticipated with this alternative. The use of existing infrastructure to implement this alternative will not require the disturbance of land, ecosystems, or water resources or create additional air pollution, solid waste, or increase energy consumption. Any removal or discarding of unneeded materials would be in accordance to Federal and State regulations using best practices.

- **Implementation Feasibility –** Conversion of the runway into a taxiway may increase confusion among pilots not familiar with the airfield on whether the surface is an active runway. Coordination and communication with Federal and State officials, air traffic control officials, and airport tenants will be essential to help address any questions or concerns prior to design and implementation. Closure of the runway would also eliminate an additional runway to accommodate crosswinds, potentially impacting the operations of small, light aircraft. An increase in the number of flight delays and cancellations for these aircraft may result, though no significant impacts are anticipated based upon the limited use of the surface as reported by FAA Air Traffic Control officials.

- **Summary – Table 4-1** summarizes the advantages and disadvantages of this alternative.

Table 4-1
Alternative 1 Summary – Runway 9/27 Decommission

Advantages	Disadvantages
• Achieves recommended wind coverage • Airfield capacity increases (reduced taxi times) • No change to throughput capacity • Low relative cost to implement • Reduces airfield maintenance and operational costs • No constraints or significant environmental impacts	• Loss of additional runway to accommodate crosswind conditions • Potential to increase delays and flight cancellations for aircraft most affected by crosswinds

4.2.b Preferred Alternative – Two logical development options exist when reviewing the necessity of Runway 9/27; expand the capabilities of the runway to support an increased number of aircraft types or decommission the surface and convert it into a taxiway. Review of local winds at the Airport indicate that Runway 17/35 and Runway 5/23 are capable of meeting the FAA's recommended coverage in a 10.5 knot crosswind, the maximum component acceptable for most small aircraft to safely conduct takeoffs and landings.

With distribution of federal funds limited to a single instrument runway unless additional runways can be justified, the FAA may offer little to no support for expanding the capabilities of Runway 9/27 considering Runway 5/23 is capable of meeting high level of crosswind coverage. FAA Order 5100.38C outlining general eligibility and project requirements for projects to receive federal funding identifies only the minimum number of crosswind runways are eligible unless the volume of airport operations would justify its development. Given the existing limited usage of Runway 9/27, the acquisition of federal funds to expand runway infrastructure may not be an available funding mechanism to support improvements.

Decommissioning Runway 9/27 and utilizing the surface as a taxiway offers an opportunity for the Airport to reduce maintenance and operational expenses while providing sufficient wind coverage with the remaining orientation of runways. As FAA funding is not anticipated for future rehabilitation projects, decommissioning and converting the surface into a taxiway reduces the level of financial commitment for maintenance of the pavement by the Airport. Cost savings will also be experienced in operational expenses such as snow removal as a lower priority will be assigned in the timely removal of snow and ice from the surface.

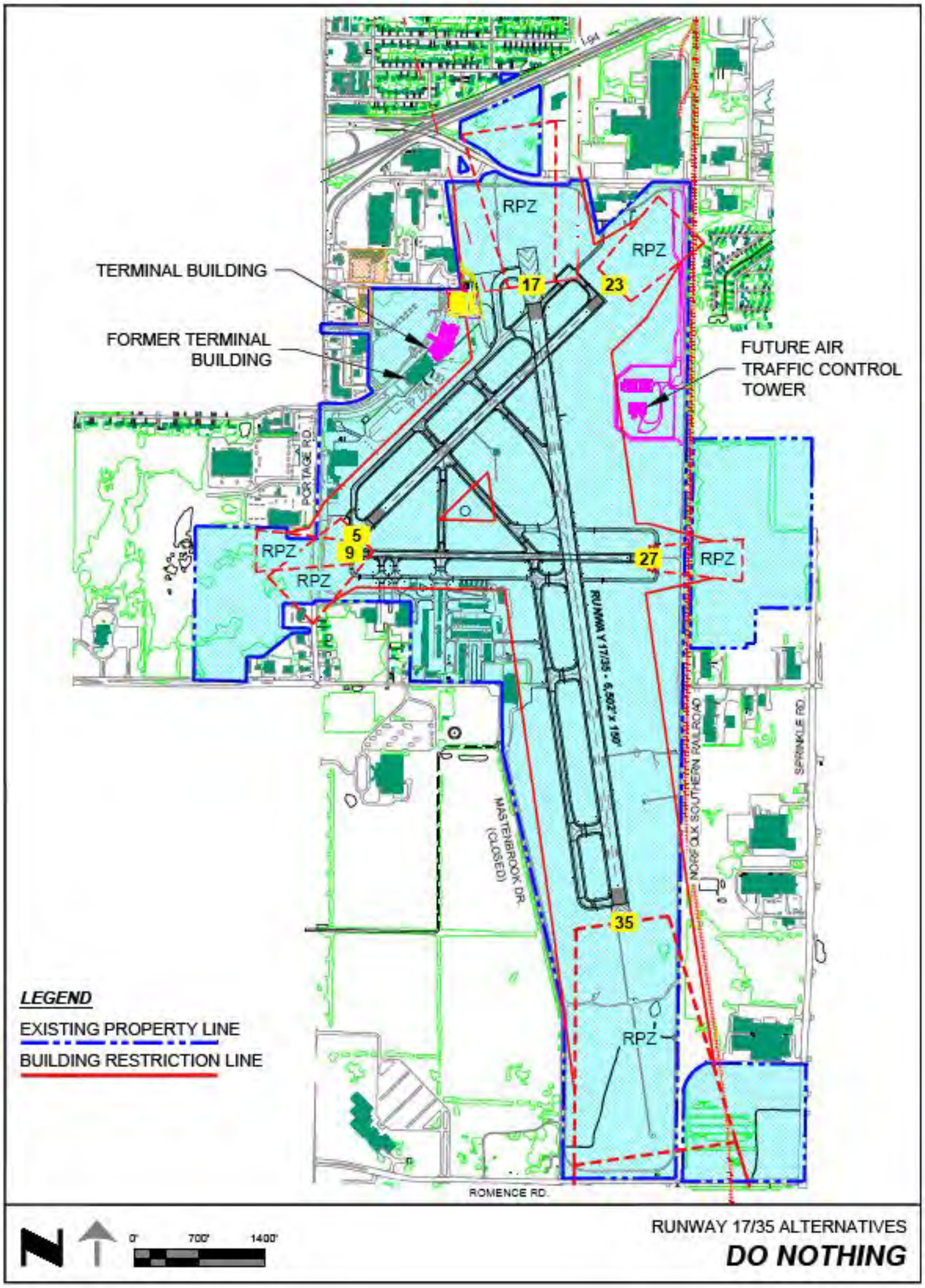
Therefore, closure of the surface and its conversion into a taxiway is the preferred alternative when reviewing the necessity of Runway 9/27. This provides the most feasible and cost effective option when reviewing the future utilization of this pavement surface while maintaining the Airport's ability to provide adequate wind coverage with its existing orientation of runways.

4.3 Runway Length Needs

As part of the Master Plan study, the takeoff and landing distance requirements of existing and anticipated aircraft types were evaluated to determine if existing runway lengths are sufficiently supporting needs. Particular attention was focused on the length of Runway 17/35 and its adequacy to meet the runway length requirements of newer generation aircraft that are replacing the fleets of commercial airline operators. Attention was also focused on landing distance assessments conducted by airline operators that add additional length as a margin of safety for runway surfaces contaminated with water, snow, or ice. Based on the evaluation of these takeoff and landing distance requirements, 1,000 feet of additional runway length is recommended for Runway 17/35. The following sections present options to increase the length of the primary runway while considering surrounding constraints, project feasibility, and the locations of other future Airport improvements.

4.3.a Alternative 2 – Retain Existing Runway Length (Do Nothing Alternative) – This alternative proposes no changes to the existing length or alignment of Runway 17/35. The runway would remain along its existing orientation at a length of 6,502 feet and require only routine maintenance throughout the planning period. This development option is presented to evaluate any benefits or consequences if no action was taken increase runway length. **Figure 4-2** illustrates this no-build alternative.

Figure 4-2
Alternative 2 – Retain Existing Length



Source: Mead & Hunt, Inc.

- **Operational Factors –** Retaining the existing runway length and orientation will impact the operations of commercial airlines that are anticipated to replace their fleets with newer generation aircraft over the planning period. Aircraft types anticipated to increase operations at the Airport include the 700 and 900 series Canadair Regional Jets (CRJ), the 175 and 190 series Embraer Regional Jets (ERJ), and Airbus 320. These aircraft types require, at most, 7,000 to 7,500 feet of runway to takeoff at maximum gross weight in conditions that hinder performance without taking concessions in passenger load, cargo, and fuel. Concessions that would be necessary for these aircraft to operate at the Airport in these low-performance conditions limit load capacity and the distance of markets that could be served, thus limiting the number of non-stop destinations and air service development efforts.

  Runway length assessments conducted by the airlines that add additional runway length in takeoff and landing distance calculations when the runway is contaminated with water, snow, or ice will increase the number of flight delays and cancellations if additional runway length is not made available. As most commercial aircraft currently use a significant portion of the existing 6,502 feet for landings and takeoffs, the addition of newer generation commercial aircraft requiring greater runway lengths in combination with these margins of safety may increase the number of flight delays and cancellations.

- **Economic Factors –** No additional development costs would be incurred to implement this alternative, only necessary expenses to maintain the existing surface. Significant indirect economic impacts may result, though, if the additional runway length is not made available as revenue associated with landing weights, enplaned cargo, or passenger traffic will have limited growth potential if aircraft are required to take concessions to land or takeoff within the existing runway length. The profitability of airlines operating at the Airport will also be impacted as a result of these concessions since aircraft operating at maximum gross weights typically generate the most revenue per flight. Additionally, the ability to attract additional air service to new and farther destinations will be negatively impacted by the amount of runway length available.

- **Environmental Factors –** No significant environmental impacts would occur with implementation of this alternative as no development or improvements are proposed with this alternative.

- **Implementation Factors** – As stated in reviewing the Operational and Economic Factors of this alternative, several indirect impacts may result to the region's economy and quality of life if air transportation needs are not sufficiently met. With the effective movement of people, goods, and services an important element to facilitating growth in all aspects of local communities and the region, increasing the runway's length to accommodate the operational requirements of aircraft will allow the Airport to adequately meet existing and anticipated air transportation requirements.

- **Summary – Table 4-2** summarizes the review of factors for retaining the existing length of Runway 17/35.

Table 4-2
Alternative 2 Summary – Retain Existing Length Runway 17/35

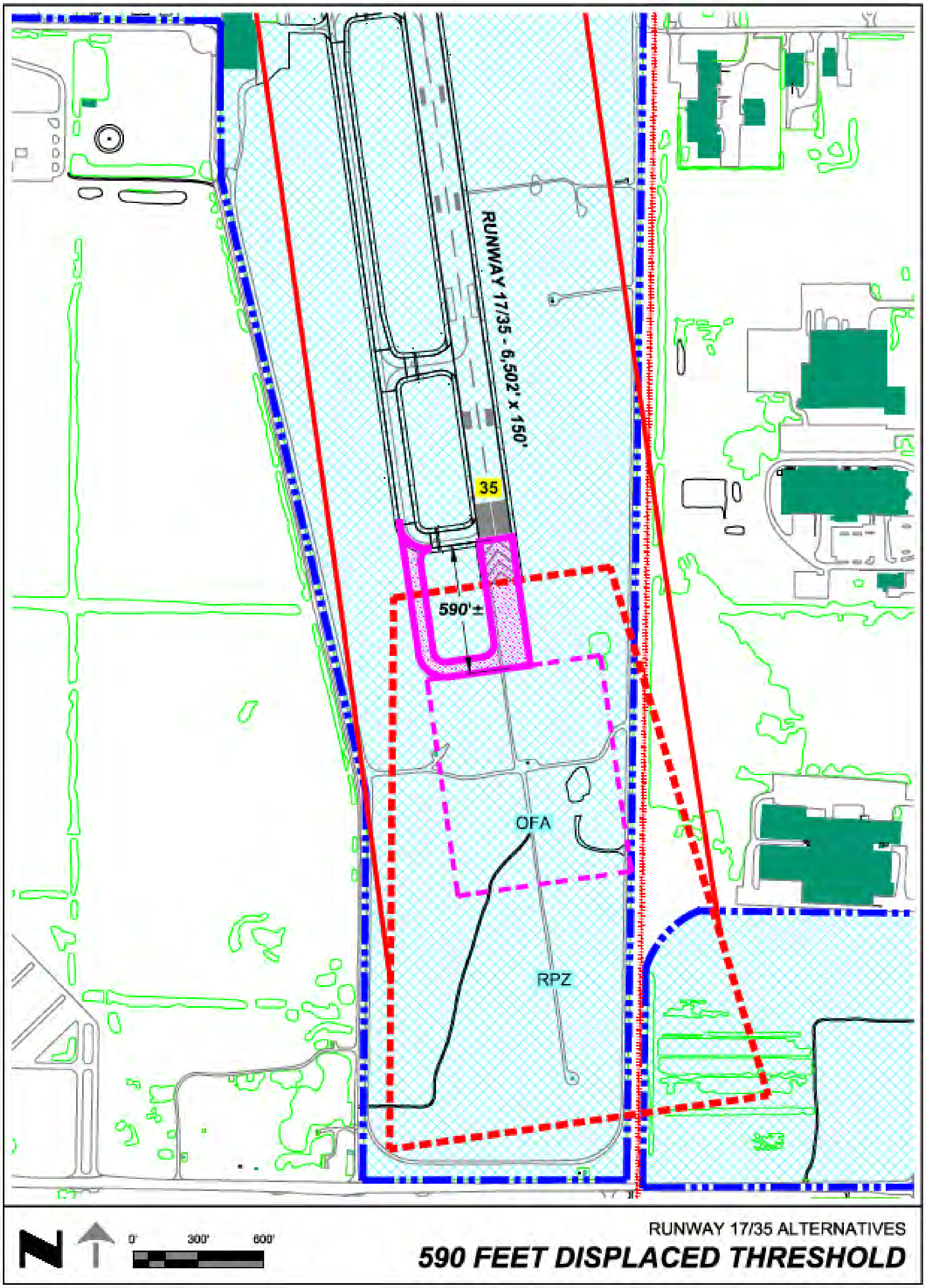
Advantages	Disadvantages
• No changes to existing infrastructure • No developmental costs for implementation • No significant environmental impacts • No tangible or intangible factors that would impact feasibility	• Runway length requirements of existing and anticipated aircraft will not be met • Negatively impact air service development efforts • Limits non-stop destinations served from Airport • Passenger/cargo/fuel load concessions necessary for some aircraft types • Runway contaminate assessments requiring additional length may increase flight delays and cancellations

4.3.b Alternative 3 – 590 Feet Extension with Displaced Threshold – Alternative 3 proposes extending the runway 590 feet to the south, the maximum distance possible that would retain the relocated Object Free Area (OFA) within the boundaries of existing Airport property. The extension would require the displacement of the Runway 35 threshold, resulting in 7,092 feet of available runway for Runway 35 departures while 6,502 feet would be maintained for Runway 17 arrivals, Runway 17 departures, and Runway 35 arrivals. **Figure 4-3** illustrates the extended runway and relocated Airport design surfaces proposed by Alternative 3.

- **Operational Factors –** An additional 590 feet of runway for departures will allow aircraft to operate at greater load and fuel capacities and help satisfy the takeoff distance requirements of newer generation commercial aircraft. Using declared distances, the existing approach to Runway 35 would be retained and no additional land acquisition or relocation of as Romence Road or the railroad would be necessary to keep the traverse ways clear of airport design surfaces and within the limits of designated heights for obstruction clearances.

- **Economic Factors –** Approximately $5.8 million in construction costs are estimated to implement this alternative, including necessary grading, earthwork, extension of the runway and associated parallel Taxiway B surfaces, reconfiguration of airfield electrical and signage, and relocation of runway approach lighting.

Figure 4-3
Alternative 3 – 590 Feet Extension with Displaced Threshold



Source: Mead & Hunt, Inc.

- **Environmental Factors –** No significant environmental impacts are anticipated with development of this alternative. Though land located approximately 500 feet southeast of the existing runway end has been preliminary designated as wetland by the Michigan Department of Natural Resources and Environment (DNRE), disturbance of this area to implement the proposed project is not anticipated.

- **Implementation Factors –** Partial closure of the runway would be necessary during construction to retain airport design surfaces intended to provide a margin of safety for both aircraft and construction equipment and personnel. In providing a 1,000 feet safety area and OFA off the end of the runway, the distance of Runway 17/35 would be reduced to 5,502 feet during construction. This temporary reduction in length may impact flight operations with the limited available distance for takeoffs and landings, resulting in further reduced load capacities and increasing the potential for flight delays and cancellations.

  Although this alternative would increase runway length and enhance the margin of safety for Runway 35 departures, it would not provide sufficient length for the maximum distances required for both takeoffs and landings of existing and anticipated commercial aircraft. Concessions would still be required in passenger, cargo, and fuel loads for some aircraft types, though the level of these would not be as significant if no additional runway length was made available.

- **Summary – Table 4-3** summarizes the advantages and disadvantages of Alternative 3.

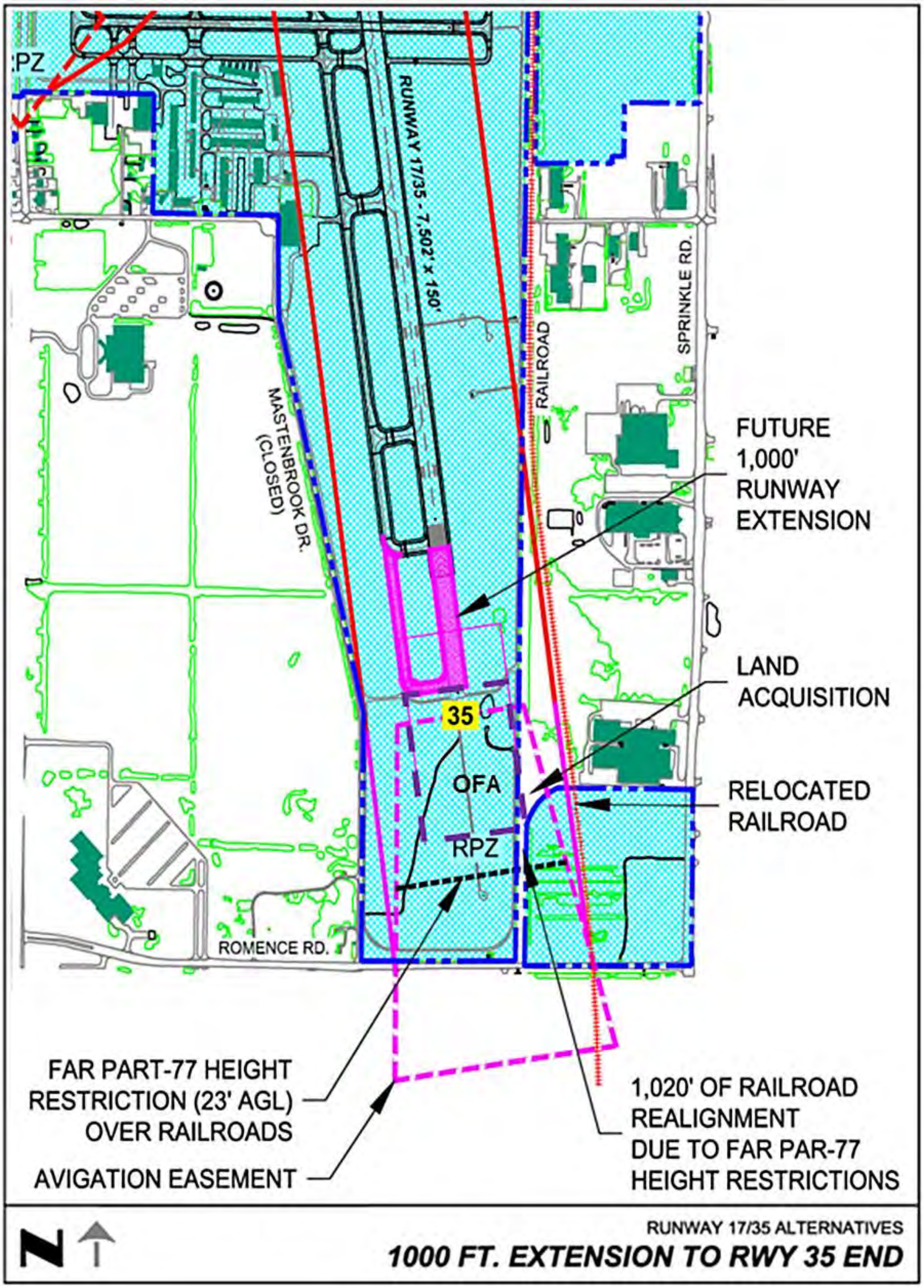
Table 4-3

Alternative 3 Summary – Runway 17/35 590 Feet Extension with Displaced Threshold

Advantages	Disadvantages
• Increase runway length for Runway 35 departures • No land acquisition necessary • No relocation of Romence Rd. or railroad • No objects penetrating relocated Runway 35 RPZ • $5.8 million cost	• Partial closure of runway necessary during construction • Relocation of approach lighting system • Timeline for project implementation • Does not provide enough length for maximum takeoff or landing distances

4.3.c Alternative 4 – 1,000 Feet Extension to South – Alternative 4 proposes extending Runway 17/35 and parallel Taxiway B 1,000 feet to the south. 7,502 feet of runway length would be available for both arrivals and departures of Runway 17 and Runway 35. The Runway 35 OFA and Runway Protection Zone (RPZ) would also be relocated 1,000 feet south of their existing locations. **Figure 4-4** illustrates the improvements proposed by Alternative 4.

Figure 4-4
Alternative 4 – 1,000 Feet Extension to South



Source: Mead & Hunt, Inc.

- **Operational Factors –** Extending the runway to 7,502 feet would sufficiently meet the maximum takeoff and landing distance requirements of most existing and anticipated commercial aircraft operating at maximum gross weights in conditions that hinder performance. Additional runway length also provides an additional margin of safety for landing distance assessments when the runway is contaminated with water, snow, or ice, thus lessening the number of flight delays and cancellations that may result from these conditions. Air service development efforts would also be more successful because the 7,502-foot length of the runway would be attractive in marketing the Airport to commercial airlines. The longer runway could support a greater range of aircraft types and increase the range of markets that could be reached via a non-stop flight.

- **Economic Factors –** Construction costs to implement this alternate is estimated at $9.5 million and include necessary earthwork, paving the extensions of the runway and Taxiway B, and relocating airfield infrastructure items such as runway and taxiway edge lighting, signage, approach lighting, and the relocation of 6,600 feet of railroad as this would fall within the relocated RPZ. Additional cost would be incurred for necessary land acquisition to relocate the railroad and for avigation easements that would be necessary south of Romence Road as a result of relocating the RPZ.

- **Environmental Factors –** Extension of the runway may impact a small wetland area located approximately 500 feet southeast of the existing approach end of Runway 35, though any disturbance of this area is anticipated to be minimal and can be easily mitigated. Although an increase or additional noise impacts are not anticipated as a result of the runway extension since most land south of the Airport is not for residential use, a noise analysis as defined by FAA Order 1050.1E (FAR) Part 150, *Environmental Impacts: Policies and Procedures*, will be required. The existing Federal Aviation Regulation (FAR) Part 150 noise analysis for the Airport also may need to be updated to review the change in the Day-Night Sound Level (DNL) contours that may occur with the relocated runway threshold.

  It should be noted that the location of the Airport was once the site of a large Native American settlement during the 18th century that included a burial ground. Although the burial ground was relocated to a cemetery off existing Airport property when European explorers settled the area in the 19th century, historical remains could be encountered during any project requiring earthwork. If any tribal remains were found during construction of the proposed alternative, work should be halted until the Michigan Office of the State Archaeologist, Michigan State Historic Preservation Office (SHPO), and appropriate Indian Tribes' Tribal Historic Preservation Officers (THPOs) are notified to determine the historical significance of the site.

- **Implementation Factors –** The location of the Norfolk Southern railroad, Romence Road, and property south of the Airport owned by Pfizer are factors impacting the feasibility of this alternative. Realignment of the railroad is necessary for the traverse way to clear the relocated OFA and RPZ and height requirements of runway approach surfaces. Effective coordination with Pfizer would be necessary to realign the railroad and limit the impact of a temporary halt in raw material deliveries during construction.

- **Summary – Table 4-4** summarizes the review of factors towards implementation of Alternative 4.

Table 4-4
Alternative 4 Summary – Runway 17/35 1,000 Feet Extension to South

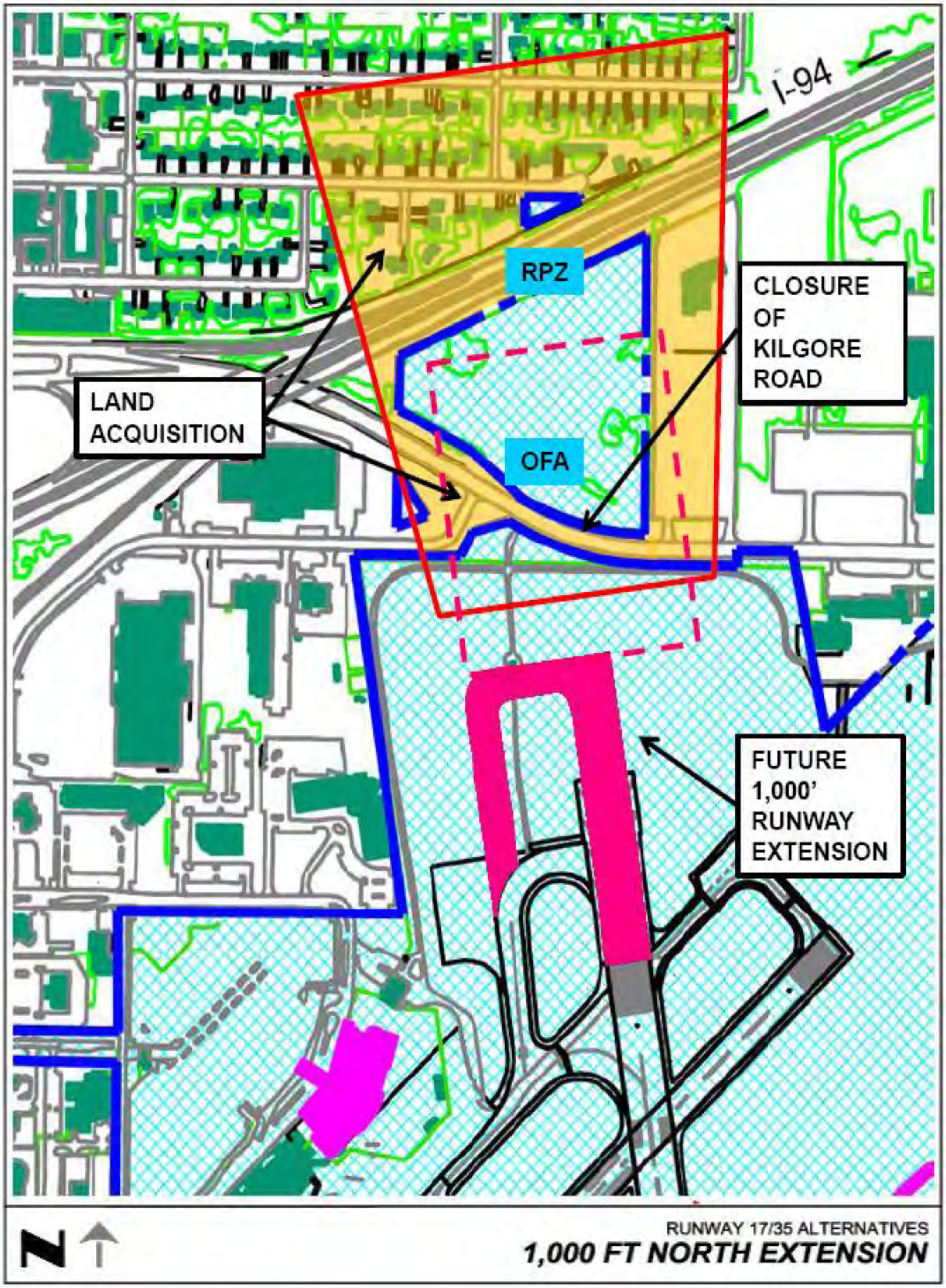
Advantages	Disadvantages
• Increases runway to preferred length • Provides margin of safety for runway length assessments • Attractive asset for air service development efforts	• $9.5 million projected construction cost • Potential wetland impact • Relocation of railroad required • Land acquisition required

4.3.d Alternative 5 – 1,000 Feet Extension to North – Alternative 5 proposes a 1,000-foot extension of the runway to the north at the approach end of Runway 17, increasing available takeoff and landing distance for both Runway 17 and 35 to 7,502 feet. Construction of a parallel taxiway to reach the extended runway end and relocation of the Runway 17 approach OFA and RPZ would be necessary. **Figure 4-5** illustrates the proposed improvements of Alternative 5.

- **Operational Factors –** Extension of the runway would provide an additional 1,000 feet for Runway 17 and 35 arrivals and departures, meeting the operational requirements of existing and anticipated commercial service aircraft. Additional length also provides an additional margin of safety for landing distance assessments calculated by the airlines when the runway is contaminated with water, snow, or ice. The 7,502 feet of runway also would help the Airport to market to commercial service airlines and to enhance and further development air service.

- **Economic Factors –** Several physical constraints to the north of the Airport limit the economic feasibility of this alternative. In addition to the cost to construct the runway extension, significant land acquisition would be required to relocate the RPZ, residential properties north of Interstate Highway 94 (I-94), and a trucking company north of Kilgore Road. Closure of Kilgore Road, a significant east-west traffic artery in the city of Kalamazoo, would also be required, resulting in economic impacts to businesses located along the road that rely on it for their transportation needs.

Figure 4-5
Alternative 5 – 1,000 Feet Extension to North



Source: Mead & Hunt, Inc.

- **Environmental Factors –** An initial review of the Michigan Department of Natural Resources and Environmental (DNRE) wetland database does not identify any such areas within the proposed project area. Initial review with USDA databases also does not identify and prime or significant farmland that would be impacted within the project area. No habitats of endangered or threatened species were preliminarily identified within the proposed development area; however, a more through environmental review will be necessary before project implementation.

  Significant socio-economic impacts would occur with implementation of this alternative. Land acquisition required for residential areas north of I-94 would relocate several residents as homes would be removed to clear objects within the relocated Runway 17 RPZ. Extension of the runway would shift the Runway 17 approach path further north, requiring a noise analysis to be conducted that would likely find an increase in aircraft noise exposure levels to a greater number of people.

- **Implementation Factors –** Significant public controversy is anticipated to implement this alternative because of the required acquisition of land, relocation of residents, and closure of Kilgore Road. Unfavorable public options as a result of this proposed alternative's implementation may increase the project's timeline up to several years with delays that could be experienced in accomplishing these tasks.

- **Summary – Table 4-5** summarizes the advantages and disadvantages of Alternative 5.

Table 4-5
Alternative 5 Summary – Runway 17/35 1,000 Feet Extension to North

Advantages	Disadvantages
• Increases runway to preferred length • Attractive asset for air service development efforts	• Significant development costs • Significant environmental impacts • Permanent closure of Kilgore Road • Interstate 94 located within RPZ • Land acquisitions necessary • Potential to increase intensity of aircraft noise exposure to north • Potential for significant public controversy

4.3.e Alternative 6 – Runway Realignment – Alternative 6 proposes realigning the orientation of Runway 17/35 in an effort to reduce the number of constraints at each end that limit extension opportunities. Realignment would also involve extending the runway to provide 7,502 feet of available length for both Runway 17 and Runway 35 arrivals and departures.

It should be noted that several surrounding constraints limit the feasibility of implementing this alternative. **Figure 4-6** identifies theses constraints. This alternative has been proposed as a measure to compare the feasibility of other runway extension alternatives.

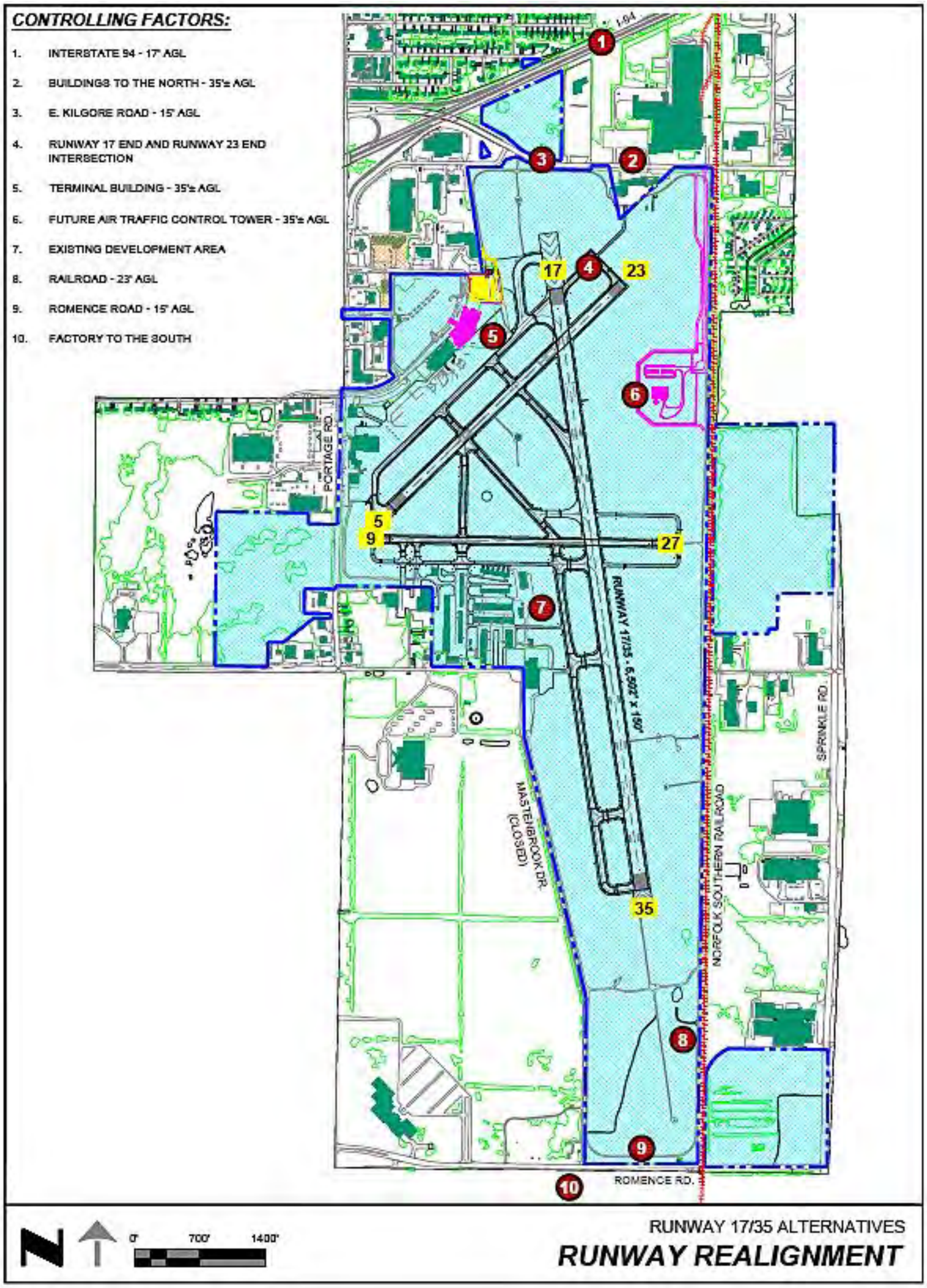
- **Operational Factors –** Realignment of Runway 17/35 is proposed to better position it for runway extension opportunities that limit the impact of surrounding constraints. Creating an additional 7,502 feet of takeoff and landing distance for both Runway 17 and Runway 35 meets the operational requirements of commercial aircraft operating at gross maximum weights and adds a margin a safety necessary in the calculation of runway distance assessments when the surface is contaminated with water, snow, or ice. Additional runway length also would contribute to the success of air service development effort by the Airport to expand or attract additional routes and destinations.

- **Economic Factors –** Shifting the alignment of Runway 17/35 is estimated to cost approximately $51.3 million, which includes the relocation of existing airfield infrastructure such as signs, lights, and navigational aids, necessary excavation, and the paving of the runway. Additional costs would be incurred for any necessary land acquisition, relocation of airfield buildings, hangars, and taxiways, any realignment of roads and/or the railroad, removal of obstructions within the new runway's approach slopes, and any mitigation for environmental impacts.

- **Environmental Factors –** Significant environmental impacts are anticipated with implementation of this alternative. Wetland areas located 500 feet southeast of the existing approach end of Runway 35 would be impacted pending on the realignment of the runway. Significant socio-economic impacts would also result from land acquisition for areas within the relocated RPZs that require the relocation of residents and businesses or realignment or closure of existing roads and the railroad to clear objects from these airport design surfaces.

  Realignment of the runway may also impact the compatibility of surrounding land uses as existing uses deemed compatible may become incompatible if the runway is shifted and the location of approach surfaces change. Objects within existing height limits may become penetrations if the orientation of the runway shifts, changing the location of approach surfaces.

Figure 4-6
Alternative 6 – Runway Realignment



Source: Mead & Hunt, Inc.

- **Implementation Factors –** Several controlling factors limit the feasibility of implementing this alternative, particularly as limited space is available to shift the runway. Constraints outside of existing Airport property limiting realignment options include the location of I-94, Kilgore Road, and residential, commercial, and industrial land uses to the north. To the east, the railroad, residential, and industrial land uses limit shifting the runway in this direction. Romence Road and industrial land uses to the south limit maneuverability to reposition the runway threshold while Portage Road and commercial and residential land uses to the west limit any shift in this direction.

  Constraints located on Airport property more significantly impact available options to shift or realign the runway. The terminal and T-hangar areas to the west and location of the new air traffic control facility to the east also limit any longitudinal shift of the runway. Proximity of the approach end of Runway 23 to the north also impacts any eastward shift of the approach end of Runway 17 as the separation between these two surfaces would be decreased. Reducing the distance between these two runway ends creates a complex airfield intersection that could result in an aircraft aligning with the wrong surface when taxiing for takeoff or when on approach to land.

  Implementation of this alternative also requires a nearly complete closure of the Airport during construction. Although use of all three runways could be utilized in phases over the course of the project, use of the primary runway, a requirement for commercial airline service, would be temporary halted during construction. An initial construction timeline to implement this alternative is estimated at two years.

- **Summary – Table 4-6** summarizes the review of factors for realignment of Runway 17/35.

Table 4-6
Alternative 6 Summary – Runway 17/35 Realignment

Advantages	Disadvantages
• Increases runway to preferred length • Provides margin of safety for runway length assessments • Attractive asset for air service development efforts	• Approximately $51.3 million in construction costs • Significant environmental impacts • Several controlling factors • Requires nearly complete closure of Airport during construction

4.3.f Preferred Alternative – Review of the maximum takeoff and landing distance requirements for current and anticipated commercial aircraft types to operate at gross weights in poor performance weather conditions identifies a need to increase the length of Runway 17/35. The existing runway length requires some of these narrow-bodied and regional jet aircraft to take concessions in passenger, cargo, and fuel loads to safely takeoff and land within the allotted distance. This reduces the profitability of these flights and limits the range of destinations that can be reached non-stop from the Southwest Michigan region. Anticipation of a greater number of operations from these aircraft types and federal regulations that may require a margin of safety to be included when landing distance assessments are calculated when water, snow, or ice is present on the surface demonstrates a need for additional runway length.

Several constraints located both on and off the Airport limit the number of alternatives that can be developed in reviewing options to extend the length of Runway 17/35. The locations of existing Airport infrastructure such as the terminal and T-hangar areas and proposed developments such as the new air traffic control tower and approach control facility limit the ability to shift or change the orientation of the runway. Off-airport constraints such as the proximity of Portage, Romence, and Kilgore roads, I-94, the railroad, and surrounding residential, commercial, and industrial areas also limits feasible alternatives that require land acquisition.

Alternatives proposed in this section present the most logical options to provide additional runway length. Each proposal provides a means to increase Runway 17/35's length while considering infrastructure, environmental, and financial constraints. Evaluation of the level of benefits gained compared to the disadvantages of each alternative provide a method for identifying a preferred development action.

Determining that additional runway length is required, Alternative 2 is not recommended as it will be unable to sufficiently meet the increasing demand for additional runway length. No changes to the existing length of the runway will significantly impact the ability of the Airport to meet the air transportation needs of the Southwest Michigan region. Lack of additional length will impact air service development efforts, limit the range and number of non-stop destinations served by the Airport, and contribute to flight delays and cancellations as a result of contaminates present on the runway surface or weather conditions that impact aircraft performance.

Alternative 3 proposes extending the runway 590 feet utilizing a displace threshold to increase the length to the maximum distance possible within the design limits of existing Airport property. Though this offers a solution to extend Runway 17/35 to a distance of 7,092 feet without the need for land acquisition, it will not provide the recommended length of approximately 7,500 feet needed to meet the maximum runway length requirements of existing and anticipated aircraft. Therefore, this Alternative is not recommended.

Alternative 5 proposes extending the runway 1,000 feet to the north, providing a total length of 7,502 feet that would meet the recommended distance for commercial aircraft types anticipated to operate at the Airport through the planning period. Although this alternative offers a solution to providing the recommended runway length, impacts to several surrounding constraints such as the closure of Kilgore Road, the location of I-94 within the shifted runway protection zone, and land acquisition needed to relocate residents in mitigating land uses within the relocated RPZ does not support the feasibility of this option. As numerous developmental and financial constraints would need to be mitigated, this alternative not recommended.

Realignment of the existing runway in creating additional space to extend the runway is proposed in Alternative 6. Numerous constraints located both on and off Airport property impact the feasibility of this development option. Notwithstanding is the fact that a nearly complete closure of the Airport would be necessary during construction, impacting air transportation in the region. With an estimated construction cost of approximately $51.3 million, not including land acquisition and relocation of existing Airport infrastructure, and an estimated construction timeline of approximately two years, this alternative is not recommended.

Analysis of each alternative identifies that Alternative 4 is the preferred development action to provide additional runway length by extending the surface 1,000 feet to the south. Although a small land acquisition and relocation of the railroad to the east is necessary to clear objects from the relocated RPZ and to allow for adequate height clearances for the traverse ways located within, this option provides the most cost effective and feasible alternative to provide 7,500 feet of runway. Should delays be anticipated in receiving funding, acquiring land, relocating the railroad, negotiating easements, or relocating runway approach navigational equipment, a phased approach constructing the 1,000 foot extension and utilizing declared distances until challenges are resolved provides an option to implement this alternative. Regardless of the avenue to implement this alternative, it is recommended that extension of Runway 17/35 1,000 feet to the south will sufficiently allow the Airport to meet the runway length requirements of anticipated aircraft types throughout the planning period.

4.4 Instrument Approaches

Instrument approaches are published procedures utilizing ground and satellite-based equipment that emit guidance signals for properly equipped aircraft to navigate an approach in conditions limiting a pilot's visibility, such as inclement weather and low cloud ceiling heights. In reviewing the adequacies and deficiencies of instrument approaches at the Airport, it was recommended an approach to Runway 17 that provides a visibility minimum less than one mile would increase the all weather capabilities of Runway 17/35. Development of an approach with a visibility minimum of three-fourths (3/4) of a mile provides a cost-effective alternative to increase the instrument approach capability within existing design standards. The following alternative reviews advantages and disadvantages of improving the instrument approach capability of Runway 17.

4.4.a Alternative 7 – LPV Approach to Runway 17 – Alternative 7 proposes utilizing Global Position System (GPS) and Wide Area Augmentation System (WAAS) signals to establish a Localizer Performance with Vertical Guidance (LPV) approach to Runway 17. No installation of ground-based navigational equipment would be required since satellite-based GPS and WAAS signals would provide vertical and horizontal guidance information for properly equipped aircraft to navigate an approach following FAA established procedures.

- **Operational Factors –** Establishment of an LPV approach to Runway 17 would increase the throughput capacity of the runway, especially during low visibility and inclement weather conditions. Runway 35 is the only runway at the Airport with equipment and established procedures to permit aircraft landings when visibility is less than one mile. An LPV approach to Runway 17 would give two runway options for arriving aircraft in conditions with less than one-mile visibility

Installation of an LPV approach also would contribute to a reduction in the number of weather-related delays and cancellations for arriving flights. In wind conditions favoring the use of Runway 17 when the reported visibility is less than one mile, aircraft currently may be required to delay or cancel a flight until weather improves. With Lake Michigan's influence on the meteorological conditions in the area that produce lake effect snow in the winter and showers during the warmer seasons, development of an LPV approach would lessen the number of flights impacted by local weather.

Though installation of ground-based navigational equipment would not be required to implement this alternative, some infrastructure preparation would be necessary. Removal of trees through easements or land acquisitions that penetrate the 34:1 approach slope within the RPZ located along I-94 and Kilgore Road would be required to mitigate the approach clear of obstructions. Control of future incompatible land uses and object penetrations within the 34:1 approach slope would also be necessary for the Airport to maintain this approach.

- **Economic Factors –** Implementation of this alternative would incur minimal cost for physical infrastructure development and not require installation of ground-based navigational equipment. Any costs incurred would be for the removal of existing penetrations within the slightly increased RPZ and development of the approach procedure, including design, approach slope obstruction surveys, and flight testing.

- **Environmental Factors –** No significant environmental impacts would occur with implementation of this alternative as minimal changes to existing infrastructure would be necessary. Any tree obstruction clearing would be in accordance with Federal and State regulations using industry best practices. No significant additional environmental impacts to air and water quality, habitats, species, or noise and socioeconomic issues are anticipated.

- **Implementation Factors –** The timeline necessary to develop and publish an instrument approach procedure is a factor in evaluating the alternative feasibility. Although no physical infrastructure development is required, the process to design, test, and implement an instrument approach is anticipated to require between 12 to 18 months. On-site flight tests conducted by the FAA may also delay the process based on the availability of test aircraft and preferred weather conditions to evaluate the approach procedures. After an approach is approved and published, an additional process to update FAA and other pilot publications with the procedure may include up to an additional 12 months to the project's timeline.

Additional delays through any easement or land acquisition that may be necessary could also be experienced in coordinating the tree clearing effort with property owners to removal all obstructions from the runway's approach. Although a recent approach-clearing project, completed in 2009, demonstrated a high level of cooperation between the Airport and surrounding property owners, uncooperative property owners and/or a lack of effective communication may contribute to project delays.

- **Summary – Table 4-7** summarizes the review of factors towards implementation of Alternative 7.

Table 4-7
Alternative 7 Summary – LPV Approach Installation Runway 17

Advantages	Disadvantages
• Increase Runway 17/35 throughput capacity • Reduce flight delays & cancellations associated to weather conditions • No significant physical infrastructure development needed • Low relative cost for implementation • No significant environmental impacts	• Timeline for design and development of approach • Potential project delays in removing approach obstructions

4.4.b Preferred Alternative – It is recommended that the Airport seek to establish an LPV approach to Runway 17 in an effort to increase the instrument approach capabilities of the runway. Providing a near-precision instrument approach to Runway 17 to complement the existing instrument approach to Runway 35 provides a cost-effective solution to increase the capability of the runway to support landing operations in inclement weather and low-visibility conditions. Minimum physical infrastructure improvements are necessary to implement this alternative. The only significant required action would be easement or land acquisitions that would be necessary to mitigate identified tree obstructions. Therefore this single preferred alternative is recommended to improve instrument approaches at the Airport.

4.5 Airfield Taxiway Configuration

Review of facility requirements identified that the intersection of Runway 5/23 and Runway 9/27 creates a potential airfield operational safety issue. The geometry of Taxiway C, F, and F1 and the locations of the taxiway holding positions create the potential for an aircraft to maneuver onto the wrong surface when taxiing and/or departing from the wrong surface. After a pilot receives clearance to proceed past the hold short line from air traffic control, the orientation of taxiways and runways at this intersection increases the potential of an aircraft to maneuver onto the incorrect surface and depart from the wrong runway. The following alternative presents the most feasible and prudent option to enhance the alignment of these intersecting surfaces.

4.5.a Alternative 8 – Taxiway Intersection Realignment – Alternative 8 proposes closing and removing Taxiway C south of the Runway 5/23 hold short line, Taxiway F west of Taxiway F2, and Taxiway F1. Pavement surfaces west of the Runway 5/23 and the Runway 9/27 threshold would also be closed. A new taxiway would be constructed to intersect Runway 5/23 perpendicularly between the existing Runway 5/23 hold short line on Taxiway C and Taxiway F3. **Figure 4-7** illustrates these proposed enhancements.

- **Operational Factors –** Realignment of the taxiway and runway surfaces will increase pilot situational awareness and reduce the potential for misinterpretation of Air Traffic Control Tower (ATCT) instructions. Construction of a new taxiway to intersect Runway 5/23 at a 90-degree angle offers the best visual perspective for a pilot approaching the runway to observe pattern traffic to both the right and left. This orientation also provides the optimal orientation of runway hold position markings and signs so they are visible to taxiing aircraft.

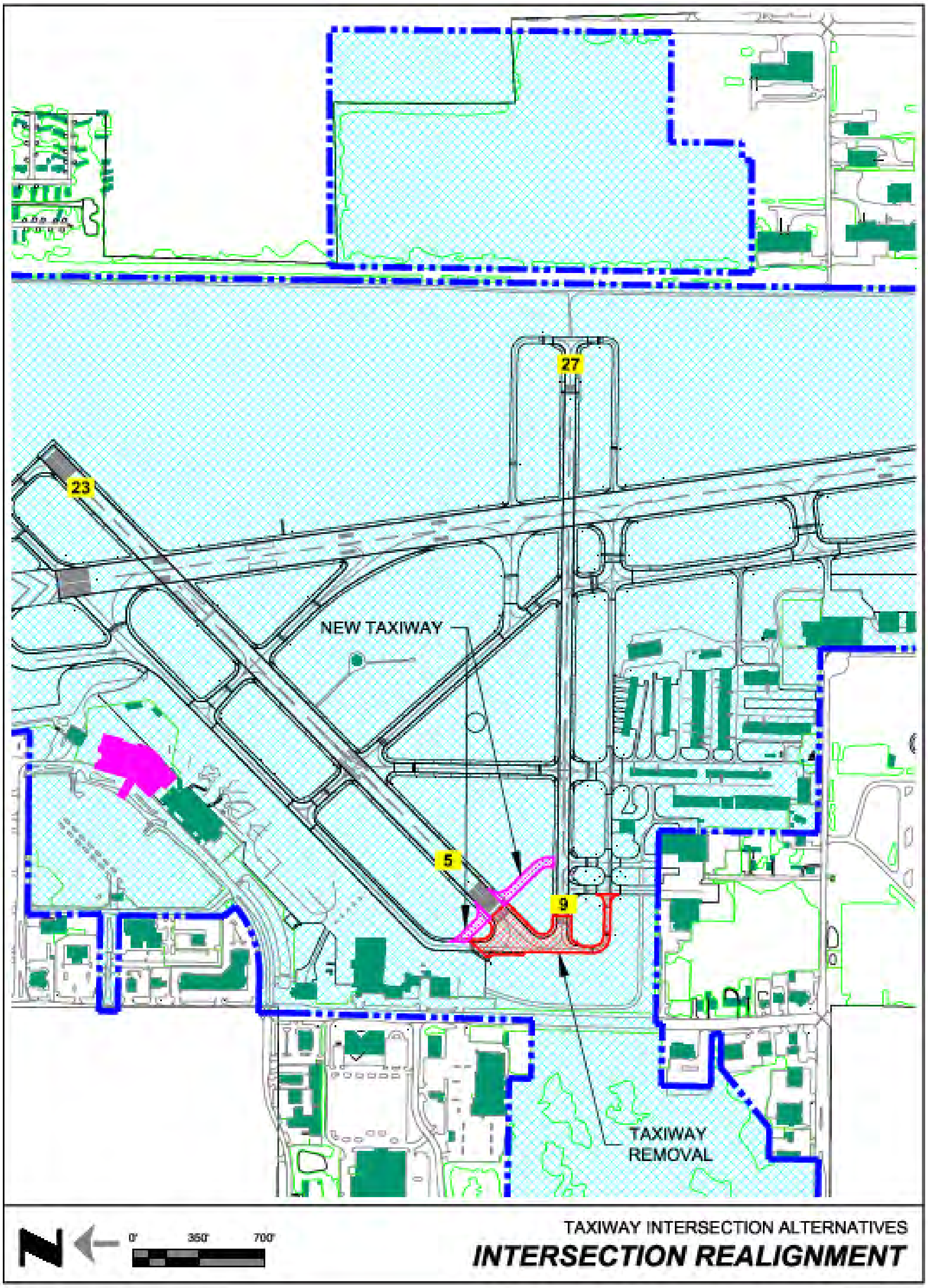
  A new taxiway also increases the distance between the approach ends of Runway 5 and Runway 9. The alignment of both runways converges to a point on Taxiway C, increasing the risk of an aircraft maneuvering onto the wrong surface when approaching from Taxiway C or Taxiway F1. Construction of a new taxiway and removal of existing taxiway surfaces eliminates the complex geometry of this intersection.

- **Economic Factors –** The estimated construction cost to implement this alternative is $1.3 million and includes the removal of existing taxiway surfaces, construction of a new taxiway, and removal or relocation of existing infrastructure elements such as signage, lighting, and pavement surface markings. No additional development costs associated with land acquisition or environmental mitigation will be necessary.

- **Environmental Factors –** No environmental impacts are anticipated with development of this alternative since changes to air and water quality, habitats, species, or socio-economic issues and not anticipated. All development would occur on existing Airport property and not require the acquisition of additional land.

- **Implementation Factors –** No significant factors are anticipated to impact the feasibility of this alternative. Coordination with ATC officials and Airport tenants will reduce the impact of construction activities on airfield operations as temporary closures of Taxiway C and Taxiway F and partial or complete closures of Runway 5/23 and Runway 9/27 will be necessary during construction.

Figure 4-7
Alternative 8 – Taxiway Intersection Realignment



Source: Mead & Hunt, Inc.

- **Summary – Table 4-8** summarizes the advantages and disadvantages of Alternative 8.

Table 4-8
Alternative 8 Summary – Taxiway Intersection Realignment

Advantages	Disadvantages
• Increases pilot situational awareness • Reduces misinterpretation of ATC instructions • Reduces potential of runway incursions • Increases pilot visibility while locating traffic while taxiing	• Partial or full closure of Runway 5/23 and Runway 9/27 during construction

4.5.b Preferred Alternative – The close proximity of the approach ends of Runway 5 and Runway 9 limit available options to change the orientation of runways and taxiways at this intersection. A single preferred alternative was developed during review of solutions to correct potential safety concerns with the existing geometry of this intersection. Construction of a new connector taxiway that perpendicularly intersects at the approach ends of Runway 5 and Runway 9 and closure of portions of Taxiway C, F, and F1 would contribute to increased pilot situational awareness when approaching these surfaces and reduce the potential for a runway incursion. Therefore, it is recommended the Airport seek improvements to the configuration of this intersection as proposed by this preferred alternative.

4.6 Aircraft Rescue and Fire Fighting/Snow Removal Equipment Building

As noted in Chapter 3, there are three buildings located east of the T-hangar area that provide storage for Airport maintenance equipment and materials. A large building with bays capable of housing snow removal and other maintenance equipment is located to the north while two smaller buildings providing additional locations for equipment and materials are located to the south. The current size of the buildings is not sufficient to store all of the necessary maintenance equipment. When maintenance equipment is stored outside, it is exposed to the elements and the length of its effective use is shortened.

The existing Aircraft Rescue and Fire Fighting (ARFF) building located near the Airport terminal area is not sufficient in size to house newer generation fire equipment and contributes to a lengthy emergency response time needed to reach the approach end of Runway 35. Construction of a new ARFF building was recommended as part of the review of facility requirements to meet the emergency response needs throughout the 20 year planning period. The following presents alternatives to address the deficiencies of the existing ARFF and snow removal equipment (SRE) buildings by evaluating options ranging from expansion of existing buildings to construction of new facilities.

4.6.a Alternative 9 – Expansion of Existing ARFF and SRE Buildings – Alternative 9 proposes expanding the existing ARFF and SRE buildings. Improvements such as larger vehicle bays, expanded offices, and increased storage area for equipment and materials would be made to the existing ARFF building north of the terminal area and to the three maintenance buildings located east of the T-hangar area (see **Figure 4-8**). The ARFF and maintenance operations would remain at their existing locations with implementation of this alternative.

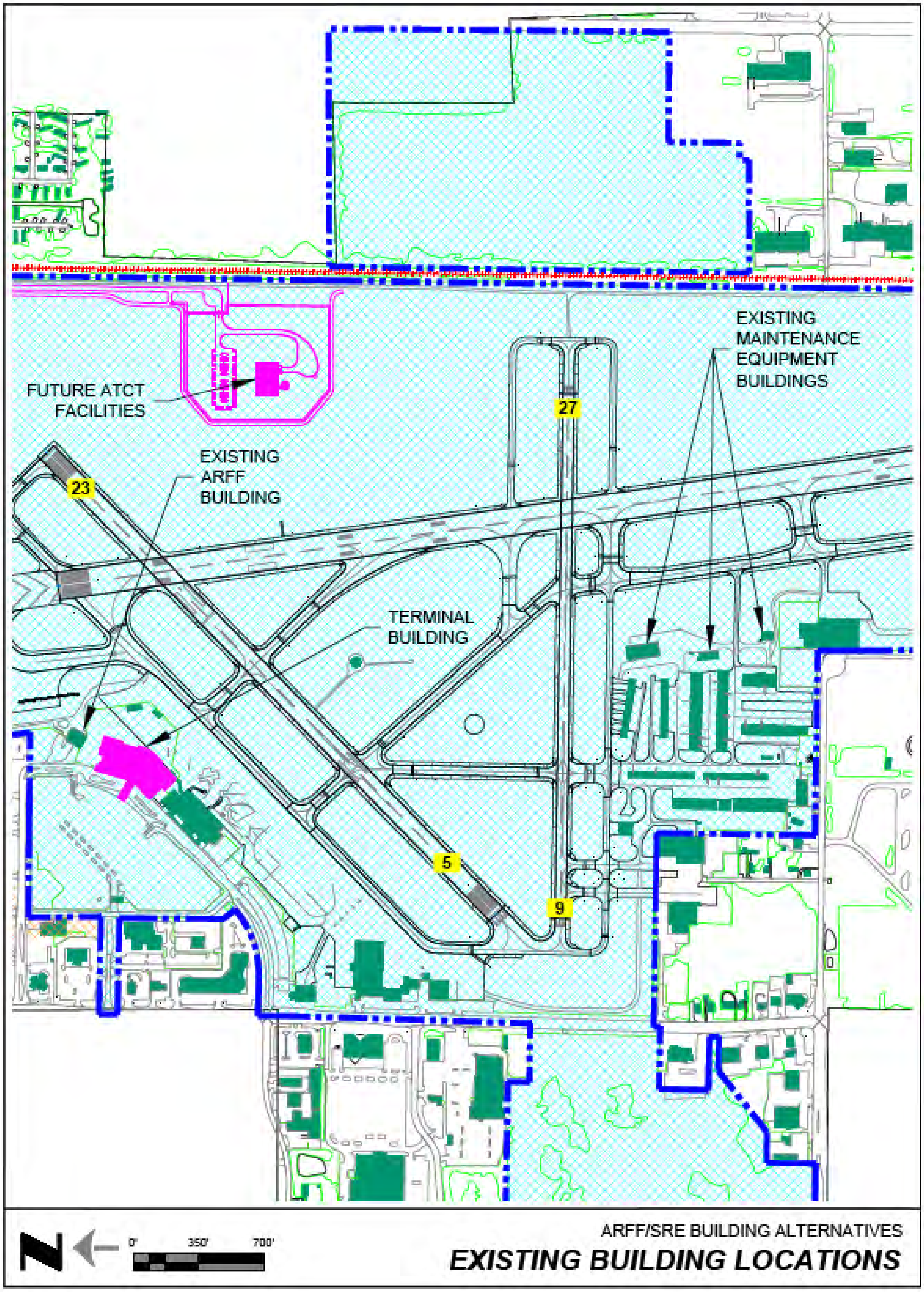
- **Operational Factors –** Expansion of the existing buildings permits ARFF and maintenance operations to remain at their current locations, freeing available on-Airport sites for other development opportunities. Landside access to the west side of the airfield where the predominant amount of Airport activity occurs would be maintained with implementation of this alternative.

- **Economic Factors –** Significant renovations would be needed to all four buildings to increase their capacity towards meeting the ARFF and maintenance equipment storage demands. The existing ARFF building would require the most extensive improvements as size of the current vehicle bay would need to be more than doubled to house newer generation firefighting apparatuses while significant improvements would be necessary to increase the capacity of the office and crew areas. Expanding the capacity of the existing maintenance facilities to provide covered storage for all pieces of equipment and raw materials may require improvements to all three SRE buildings, contributing to increased construction costs. As the cost to renovate a building is generally more expensive than new construction, improvements to up to four buildings may impact the financial feasibility of this development option.

- **Environmental Factors –** No significant environmental impacts are anticipated with implementation of this alternative as all improvements would occur on existing development locations. Care should be taken with implementation of this alternative to protect renovation crews from possible exposure to harmful building materials such as asbestos that could be present in existing building materials.

- **Implementation Factors –** Several factors impact the feasibility of this alternative. Expansion of the existing facilities does not provide for a centralized location for equipment storage, maintenance, and repair. Retention of the Airport's ARFF operations at its current location does not improve response times towards the approach end of Runway 35. Northward expansion of the terminal building and possible locations of other developments such as increased parking and a rental car quick turnaround facility are limited if the ARFF operations remain at their existing locale. Short-term implications may be experienced during the construction phase of this alternative as the utilization of these buildings to store equipment will be limited while improvements are being made. Limited options to temporarily store equipment during construction may require some components to be stored outside, exposing them to the elements.

Figure 4-8
Alternative 9 – Expansion of Existing ARFF and SRE Buildings



Source: Mead & Hunt, Inc.

- **Summary –** A summary of Alternative 9 advantages and disadvantages are presented in **Table 4-9**.

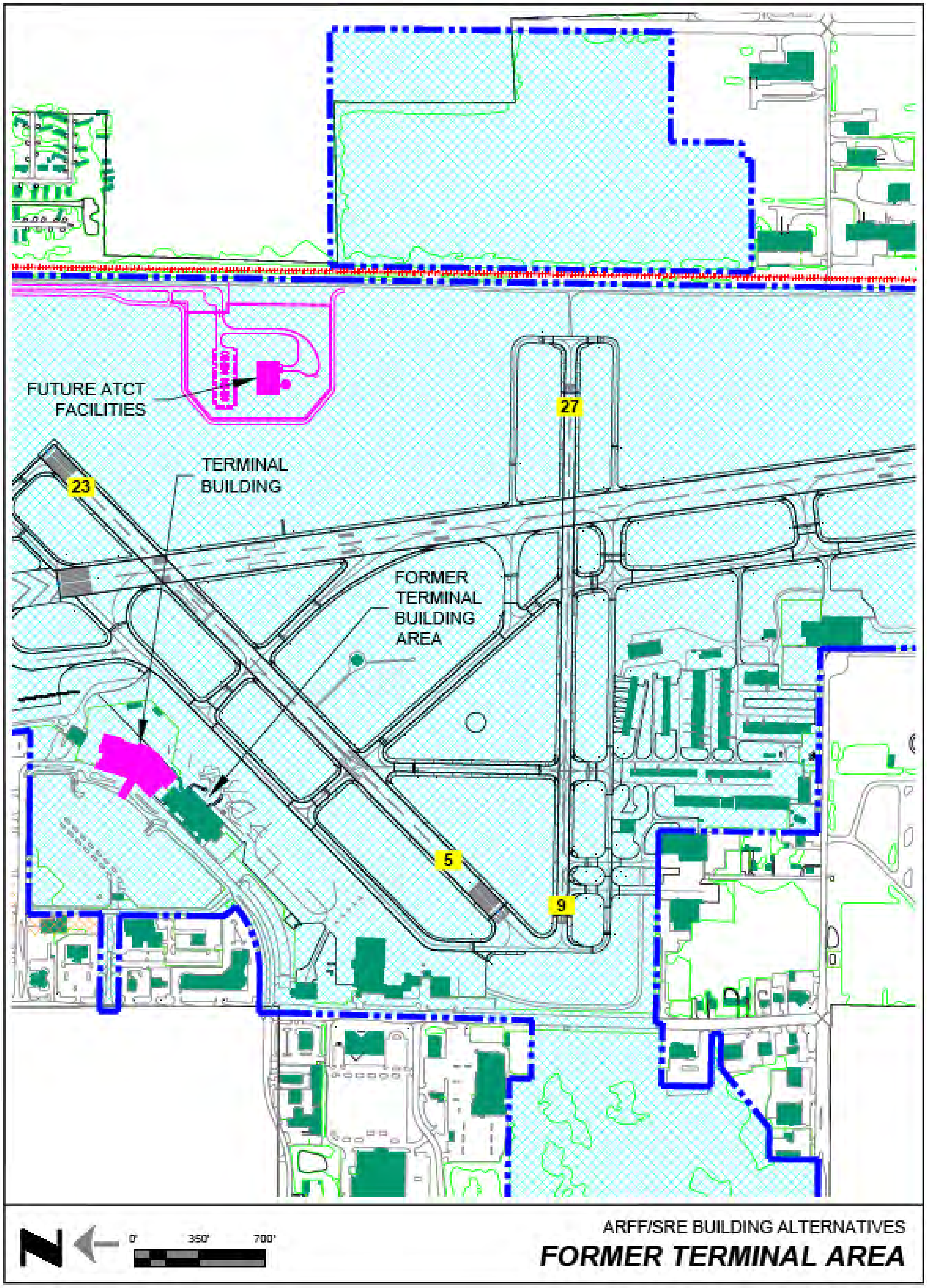
Table 4-9
Alternative 9 Summary – Expansion of Existing ARFF and SRE Buildings

Advantages	Disadvantages
• Utilizes existing building locations • Frees additional areas for other development opportunities • No significant environmental impacts	• Significant renovations needed • Cost to renovate up to four buildings • No centralized location for equipment storage and maintenance • Does not improve ARFF response times to south end of airfield • Limits northern expansion of terminal building • Limits development locations around terminal area • Temporary impact on ARFF & maintenance operations during construction

4.6.b Alternative 10 – Consolidated ARFF/SRE Building at Former Terminal Site – The site of the former terminal building is proposed in Alternative 10 for construction of a consolidated ARFF and SRE building. Partial or complete demolition of the former terminal would be necessary for implementation of this alternative. **Figure 4-9** identifies site of the former terminal building.

Figure 4-9

Alternative 10 – Consolidated ARFF/SRE Building at Former Terminal Site



Source: Mead & Hunt, Inc.

- **Operational Factors –** Consolidating ARFF and maintenance operations in a single building provides a centralized location for fire fighting and snow removal equipment storage, maintenance, and repair. Consolidating building elements such as vehicle maintenance areas, restrooms, locker rooms, and training/conference areas allows for operational and cost benefits for the Airport while increasing space for personnel office/administrative areas, work areas, and storage of other equipment, tools, and raw materials. Combining the capabilities of four existing facilities into a single building allows for increased operational efficiencies such as vehicle maintenance and repair and the resupply of raw materials such as sand, runway deicing fluid, and fire fighting foam in snow removal and ARFF equipment.

- **Economic Factors –** A consolidated building will offer the Airport operational cost savings as expenses incurred to maintain electricity, heat, gas, and water to four separate structures will be reduced. Incorporation of energy efficient fixtures and green building design in the construction of a consolidate building will offer increased operation cost savings.

- **Environmental Factors –** No significant environmental impacts are anticipated with implementation of this alternative. Care should be taken during any demolition or renovation of the former terminal to protect workers against possible exposure to harmful construction materials that may have been used such as asbestos.

- **Implementation Factors –** The level of activity that occurs in vicinity of the terminal ramp is a factor that limits the feasibility of this alternative. The proximity of the proposed site to the frequent movement of ground support equipment and taxiing aircraft may congest the area where ARFF and maintenance equipment would enter and exit the facility. Equipment entering and exiting the facility from the landside would conflict with passenger car traffic entering and exiting the terminal area. Its location without direct access to the primary runway (Runway 17/35) requires vehicles to navigate a series of taxiway intersections to gain access, potentially impacting emergency response times. The limited acreage of the site itself (2.1 acres) may not be sufficient for a facility to be constructed that is capable of housing all necessary equipment and materials. Finally, expansion options of the terminal building will be limited to the southwest if a consolidated facility is located at the site of the former building.

- **Summary – Table 4-10** lists the advantages and disadvantages of Alternative 10.

Table 4-10
Alternative 10 Summary – Consolidated ARFF/SRE Building at Former Terminal Site

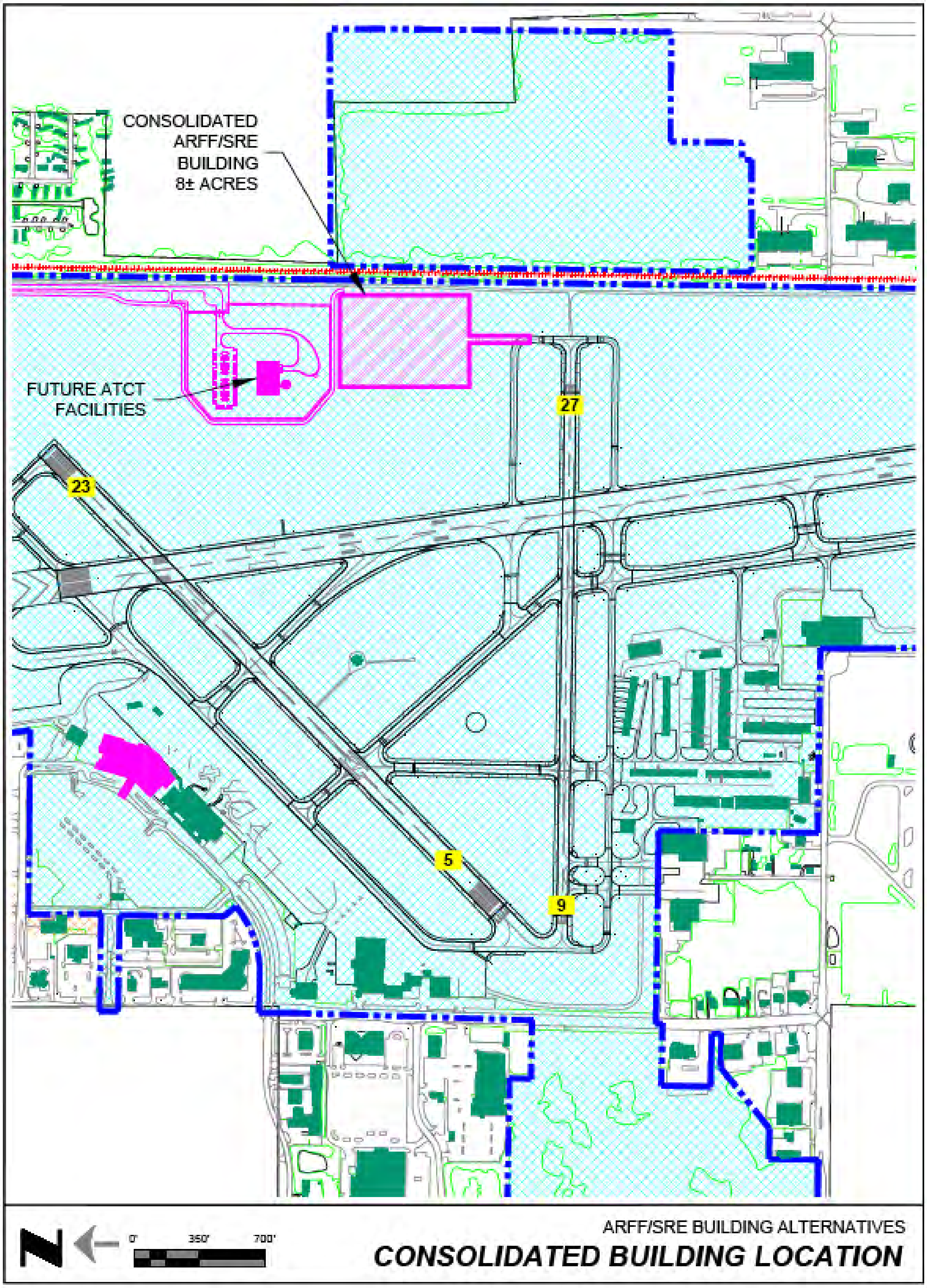
Advantages	Disadvantages
• Centralized location for ARFF/SRE equipment • Lower building operational expenses • No significant environmental impacts	• Airside access in proximity to high activity levels of terminal ramp • No direct access to Runway 17/35 • Limited site area for development of an adequate facility • Landside access in proximity to terminal area activities • Limits southwest expansion of terminal building.

4.6.c Alternative 11 – Consolidated ARFF/SRE Building Location – Alternative 11 proposes a site south of the future FAA Air Traffic Control Tower and approach control facility utilizing existing airside and future landside infrastructure for access. Pavements abandoned by the proposed closures of Runway 9/27, Taxiway F, and Taxiway G east of Runway 17/35 would utilized to provide airfield access for ARFF and SRE equipment. **Figure 4-10** identifies the site of the new FAA facility and the proposed consolidated ARFF/SRE building to the south.

- **Operational Factors –** The site selected for a consolidated ARFF/SRE building provides midfield access that reduces emergency and snow removal response times. As ARFF response requirements dictate at least one emergency vehicle be capable of responding to an on-airfield incident within 3 minutes, the more centralized location of the building will reduce response times. The timely removal of snow and ice from Runway 17/35 will also benefit from direct access at the midpoint of the runway.

  Construction of a new facility that provides adequate storage space for all existing and newer generation ARFF and snow removal equipment will protect these items from the elements, eliminating the need for outside storage and increasing the life of the equipment. A new building also enhances the work space for equipment maintenance and storage of raw materials and provides ARFF crews with sufficient room for equipment, storage, and training. Design of the building improving the flow of emergency personnel reaching the apparatus bay would also contribute to lower response times when attending to an emergency call.

Figure 4-10
Alternative 11 – Consolidated ARFF/SRE Building Location



Source: Mead & Hunt, Inc.

- **Economic Factors –** Consolidation of multiple facilities into a single facility will reduce operational expenses as efficiency would be gained with utilities such as heat and electricity. Green building design utilizing energy efficient lights and utilities and environmental design will reduce operating expenses resulting in a long-term cost savings for the Airport. Construction of such a facility is estimated to require approximately eight acres of land and is projected to cost approximately $9.7 million. This cost estimate includes necessary earthwork, connection to utilities, installation of drainage for storm water runoff, and time and materials for construction of the building.

- **Environmental Factors –** A Finding of No Significant Impact (FONSI) completed for the new air traffic control facility did not find any significant environmental impacts resulting from development activities on the east side of the airfield. Though an environmental review would still be required for development at the proposed ARFF/SRE building site, no significant environmental impacts are anticipated.

- **Implementation Factors –** Increased runway crossings for equipment to access the west side of the airfield would be a negative impact resulting from implementing of this alternative. Equipment traveling between locations west of Runway 17/35 and the ARFF/SRE facility would be required to hold short of the runway until receiving crossing clearance. Although this increases the number of vehicles needing to cross the runway, the low frequency of vehicles requiring airfield access to reach destinations on the west side of the airfield is not anticipated to impact existing or future Airport operations. Improvement of the perimeter access road to handle frequent travel of these large pieces of equipment would lessen the number of required runway crossings, though increasing response time to the west side of the airfield.

- **Summary – Table 4-11** summarizes the review of factors for the proposed site of a consolidated ARFF/SRE building.

Table 4-11
Alternative 11 Summary – Consolidated ARFF/SRE Building Location

Advantages	Disadvantages
• Midfield location reducing ARFF response time to most of airfield • Utilizes existing airfield pavements • Utilizes new ATC infrastructure for landside and utility access • Centralized location for equipment maintenance and repair • Enhanced facilities for equipment storage, maintenance, and repair • Enhanced facilities for ARFF and maintenance personnel	• Estimated cost $9.7 million • Runway crossing required to access west side of airfield • Increased distance/response time to reach west side of airfield through use of perimeter road

4.6.d Preferred Alternative – A consolidated building constructed east of Runway 17/35, as proposed by Alternative 11, is the preferred option to address the ARFF and maintenance/snow removal equipment storage needs of the Airport for the next twenty years. The primary advantage of this alternative is the area available to construct an adequately sized building to meet the vehicle storage demands of both ARFF and maintenance. The approximately eight (8) acres of land available for development is more than twice as large as the area of land available in Alternative 9 (approximately 1.7 acres) and Alternative 10 (approximately 2.1 acres) combined. Lesser acreage for development as proposed in Alternative 9 and Alternative 10 may not provide sufficient area to develop an adequately sized building that accommodates larger sized newer generation ARFF and snow removal equipment.

Demolition or renovation of existing structures is not necessary with Alternative 11, contributing to lower development costs and providing more flexibility should building design and construction challenges arise. Environmental clearance is more attainable with this alternative as its location adjacent to the new air traffic control tower and approach control facility allows it to take advantage of the approved environmental assessment that was conducted for this site. Only a categorical exclusion, conducted when actions do not significantly impact the environmental, would be required to receive the necessary clearance.

The proposed site is near the geographic center of the Airport providing direct access to Runway 17/35. This location will reduce ARFF emergency response times and allow for snow removal equipment of efficiently enter and exit the airfield. Minimal airfield infrastructure improvements would be needed as future closed surfaces would be utilized to provide access to the airfield. Therefore, Alternative 11 proposing construction of a new consolidated ARFF/SRE building offers the most practical option for the Airport's ARFF and SRE equipment storage needs.

4.7 General Aviation Development Areas

An increase in general aviation activity at the Airport is projected over the next 20 years. Despite fluctuations in the number of general aviation operations in recent years, the number of based aircraft at the Airport has increased. Though it is projected that the Airport will need an additional 20 T-Hangar units and 51,400 square feet of corporate hangar space, actual demand could be significantly greater based on the level of growth.

Several locations were examined to expand general aviation infrastructure, however, most were limited by existing and future Airport development. As a result, the most feasible alternative for general aviation expansion is through acquisition of property west of Runway 17/35 and immediately south of the area currently used for general aviation activity. The following alternative reviews development options that would be available to the Airport with acquisition of this land.

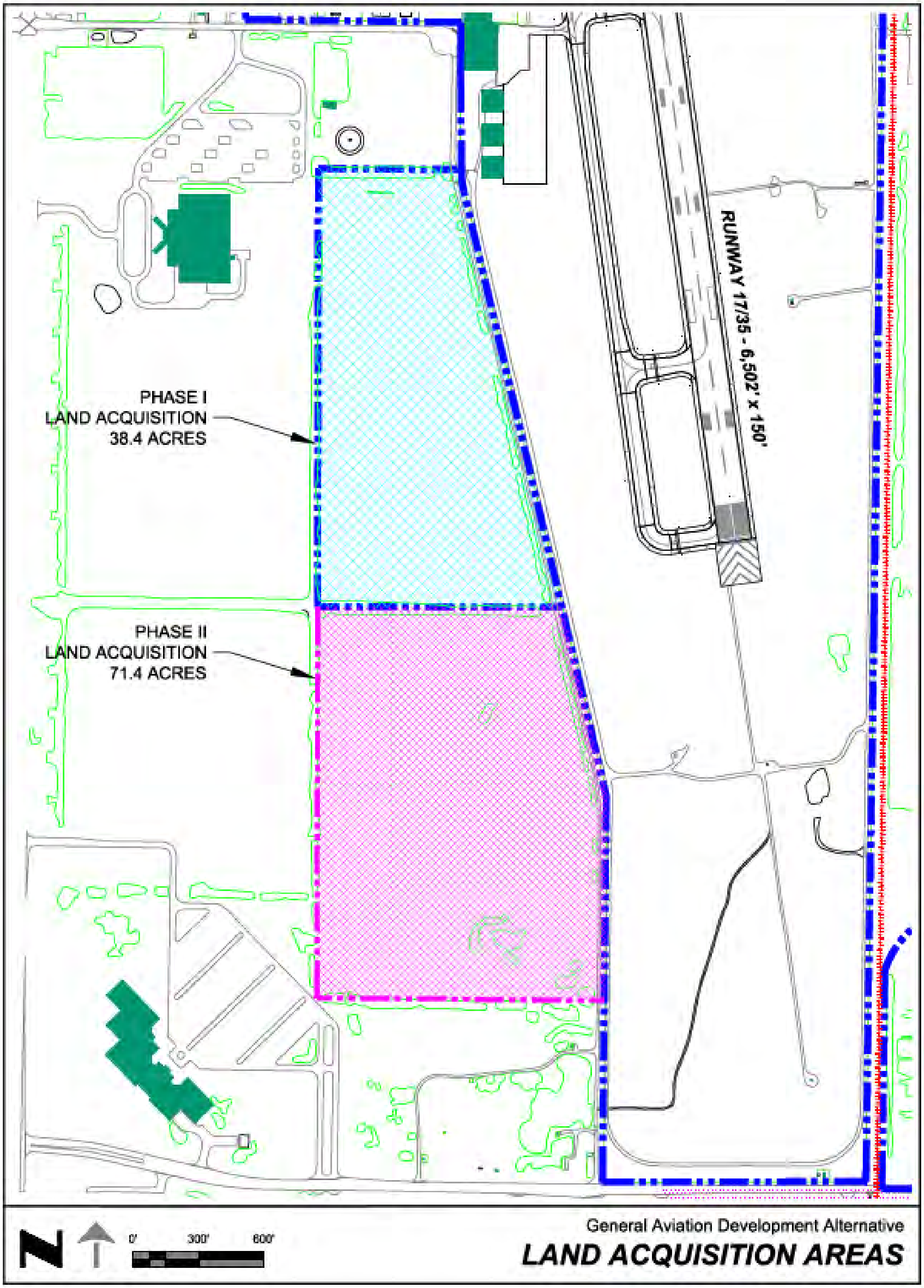
4.7.a Alternative 12 – General Aviation Development Areas – A phased development approach for general aviation development opportunities is proposed for two areas of land totaling 109.8 acres, currently owned by Pfizer to the south and west of existing Airport property,. Although all 109.8 acres of land is proposed to be acquired in a single purchase, Phase I would develop the northern 38.4 acres of land followed by a second phase to develop the remaining 71.4 acres. **Figure 4-11** identifies these two parcels of land.

- **Operational Factors –** In additional to the acquisition of the two areas of land, Phase I includes the construction of connector taxiways to provide airfield access to Taxiway B. A proposed road connecting Portage Road to the northern termination point of the former Mastenbrook Drive in front of the Kalamazoo Aviation History Museum (Air Zoo) facility would provide landside access to the Phase 1 area. Although this area is zoned as Heavy Industrial and is currently used for agriculture, according to the City of Portage's Municipal Code, the Airport would be permitted to development in this designated Heavy Industrial district. This parcel of land can accommodate approximately 100 T-hangar units and nearly 200,000 square feet of corporate hangar space as illustrated in **Figure 4-12**. Configuration of the area can also be incorporated to include an aviation-related business such as an FBO or large aircraft maintenance facility as illustrated in **Figure 4-13**.

  Development of Phase II would occur immediately to the south when demand for facilities exceeds the capacity of the Phase I area. Phase II can accommodate up to an additional 120 T-Hangar units and approximately 211,000 square feet of corporate hangar space as illustrated in **Figure 4-14** with an additional layout option presented in **Figure 4-15**. Phase II development would also include construction of an additional connector taxiway to Taxiway B and an extension of the landside access service road to existing roadway infrastructure north of Romence Road near a building formerly occupied by Pfizer.

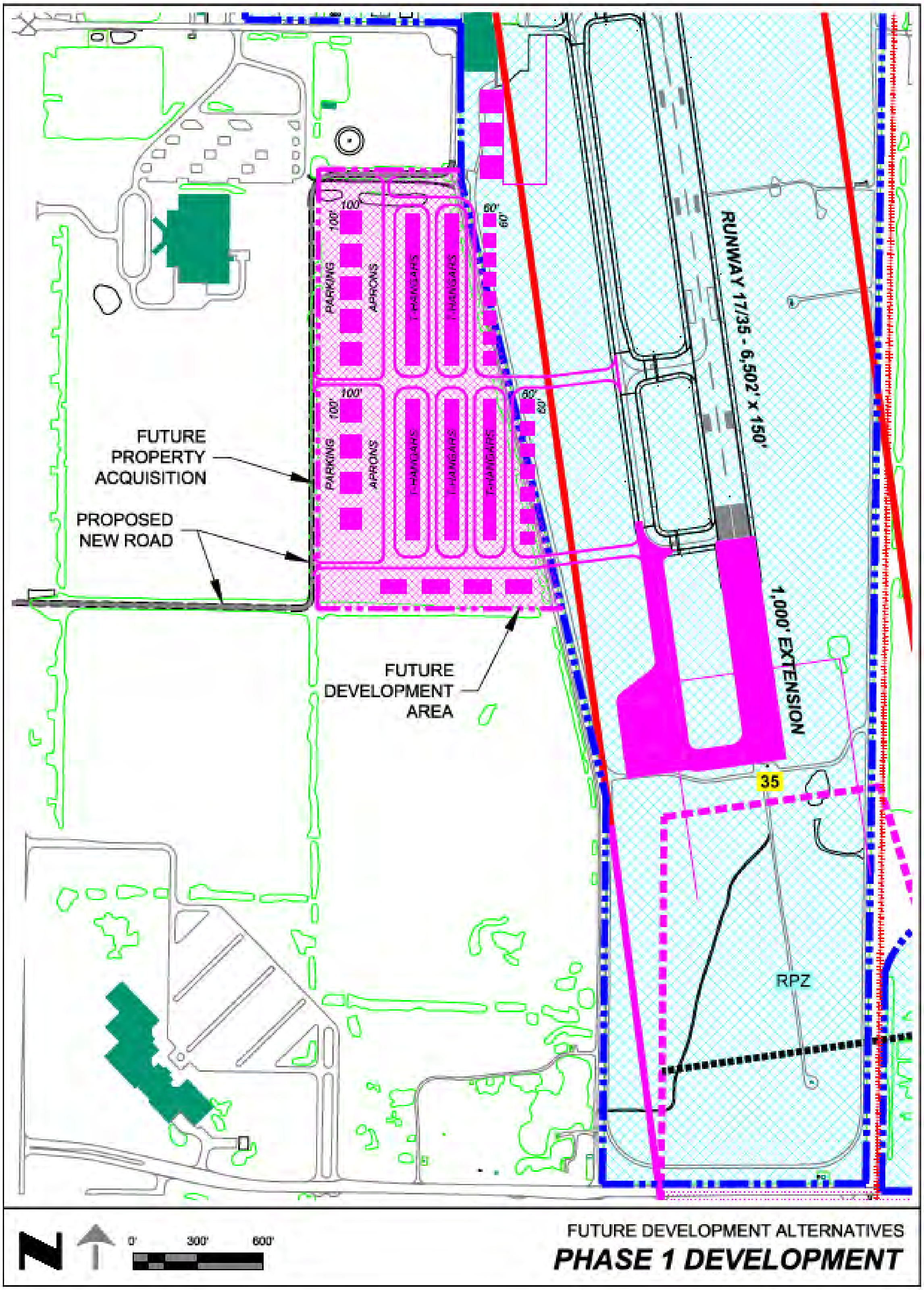
- **Economic Factors –** Economic factors impacting the implementation of this alternative include the cost to acquire the two sections of land and the development of infrastructure items such as roads, taxistreets, and utility installation. Construction of structures within this proposed area would be the responsibility of future tenants and require no additional economic support from the Airport.

Figure 4-11
Alternative 12 – General Aviation Development Areas



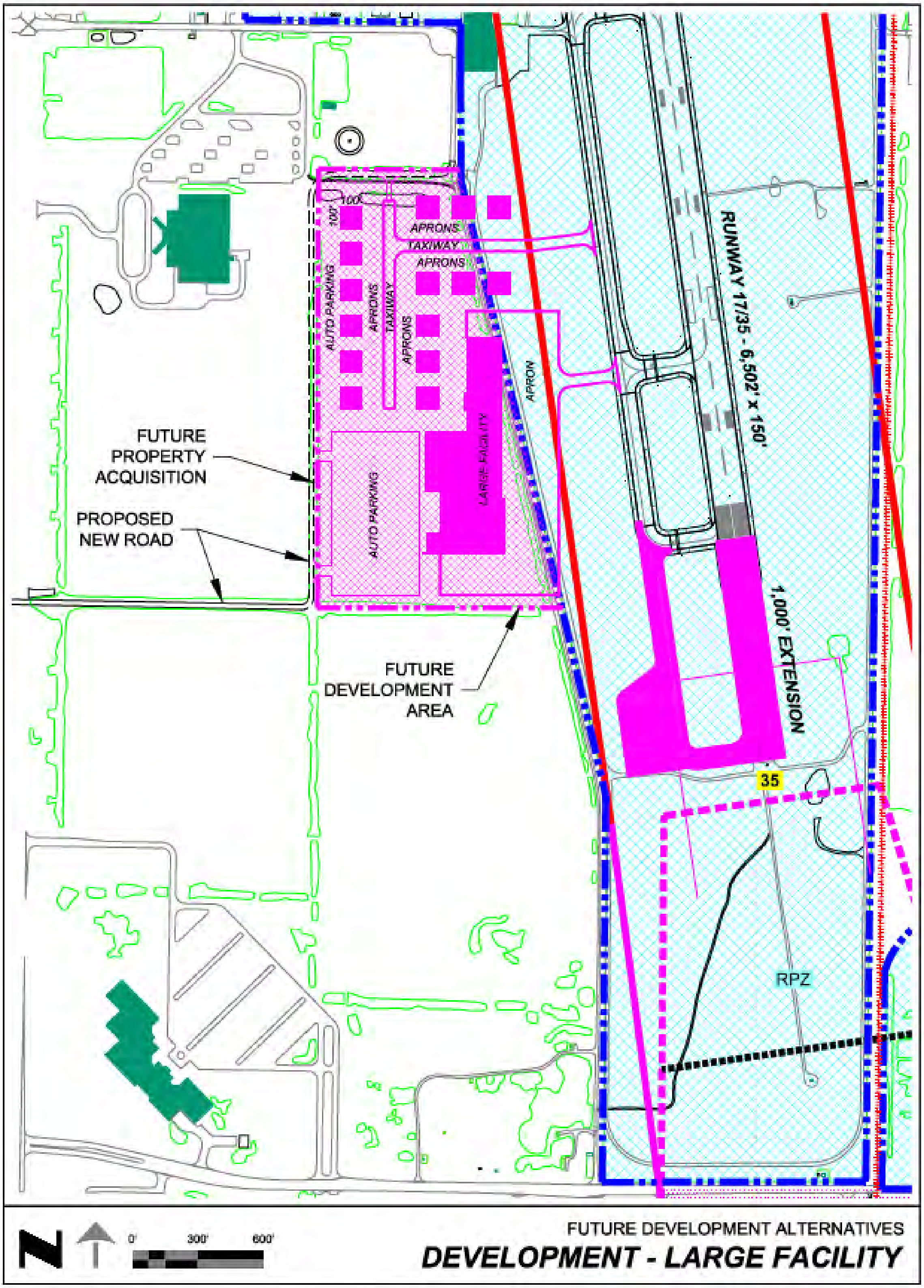
Source: Mead & Hunt, Inc.

Figure 4-12
Alternative 12 - Phase I with Private/Corporate Hangars



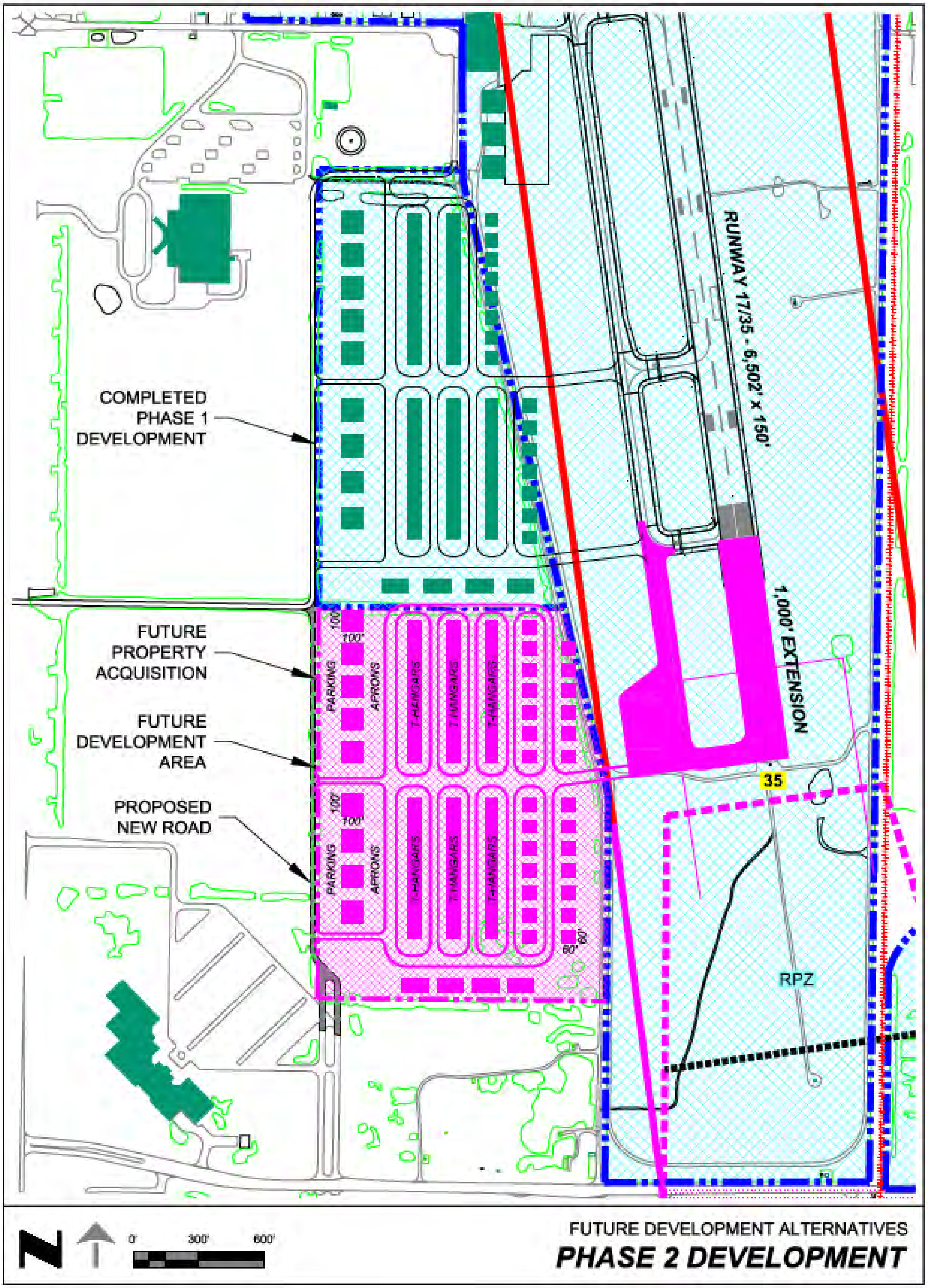
Source: Mead & Hunt, Inc.

Figure 4-13
Alternative 12 – Phase I with FBO Facility



Source: Mead & Hunt, Inc.

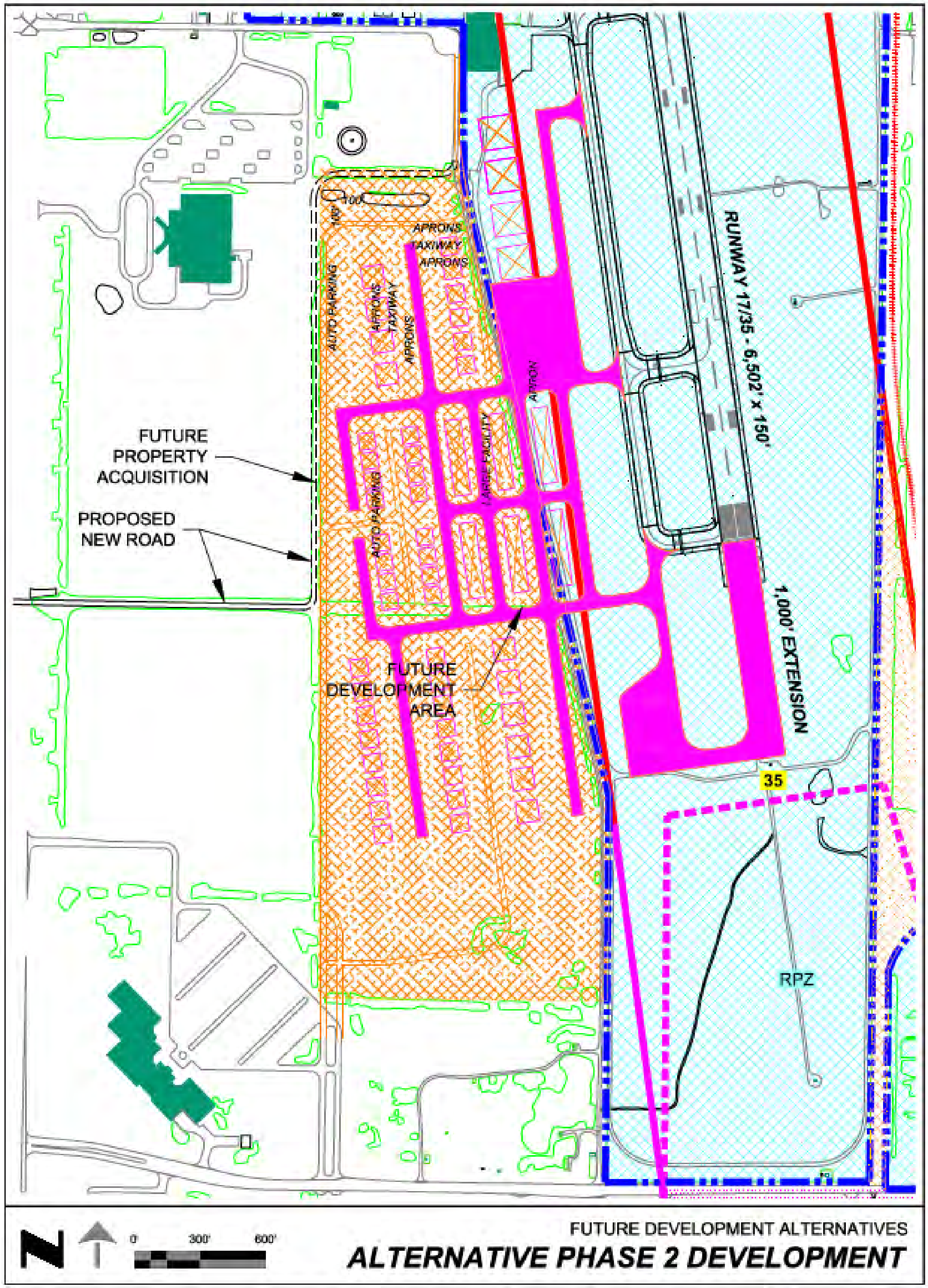
Figure 4-14
Alternative 12 – Phase II with Private/Corporate Hangars



Source: Mead & Hunt, Inc.

Figure 4-15

Alternative 12 – Additional Phase II Layout with Private/Corporate Hangars



Source: Mead & Hunt, Inc.

- **Environmental Factors –** Development on the two sections of land is not anticipated to significantly impact any environmental concerns. Initial review with USDA and Michigan DNRE records indicate no wetlands are present in the proposed areas of either Phase I or Phase II. No other identified environmental issues were found on these two areas of land; however, a thorough environmental review will be necessary before any development would occur to confirm these initial findings.

- **Implementation Factors –** Coordination with Pfizer, the City of Portage, and other local, State, and Federal officials to acquire this land is a factor impacting the feasibility of this alternative. As Pfizer has received several inquiries from public and private entities on the future use of this land, effective communication with them identifying its importance for the future development of the Airport to support the air transportation needs of the community will be a factor towards a successful acquisition.

- **Summary – Table 4-12** summarizes the review of factors towards acquiring and developing these two areas of land for general aviation purposes.

Table 4-12
Alternative 12 Summary - General Aviation Development Areas

Advantages	Disadvantages
• 109.8 acres of land available for general aviation development • Available room for numerous T-hangars and corporate box hangars • Adequate room for FBOs or other aviation related businesses	• Land acquisition required • Coordination with several entities for the release of land • Cost for infrastructure improvements such as roads, taxistreets, and utilities

4.7.b Preferred Alternative – As mentioned, several areas located both on- and off- Airport property were reviewed to identify alternatives for expanding general aviation facilities. Most were limited by existing and future development, which resulted in focusing efforts towards land acquisition options. Because of this, acquisition of approximately 109.8 acres of land to the southwest as proposed by Alternative 12 is the preferred alternative to provide additional areas for general aviation development. This option provides sufficient area for the construction of a number of configurations and sizes of general aviation facilities such as T-hangars, corporate hangars, and FBOs, well positioning the Airport to meet the needs of general aviation users throughout the next twenty years and beyond.

4.8 Through the Fence Operations

Through the fence operations are arrangements in which a private property owner has direct access to the airfield of a public airport. These types of arrangements are strongly discouraged by the FAA as it may lead to complications and possible violations in grant assurances. The FAA recommends airports enter into agreements with tenants that address assurances, access control, and federal obligations.

At the Airport, agreements have been entered with the three (3) tenants who conduct through the fence operations. Although all have been cooperative and upheld all their obligations, it is recommended the Airport review these agreements and update them as necessary according to guidelines set forth in FAA Advisory Circular (AC) 150/5190-7, *Minimum Standards for Commercial Aeronautical Activities*. Since restricting or blocking access for these tenants is not feasible because all contribute valuable services to airport users and the economy of the Airport, planning should be initiated to acquire these properties should they become available for purchase. The following alternatives review the benefits and deficiencies of upgrading these agreements and planning for the future acquisition of these properties as identified in **Figure 4-16.**

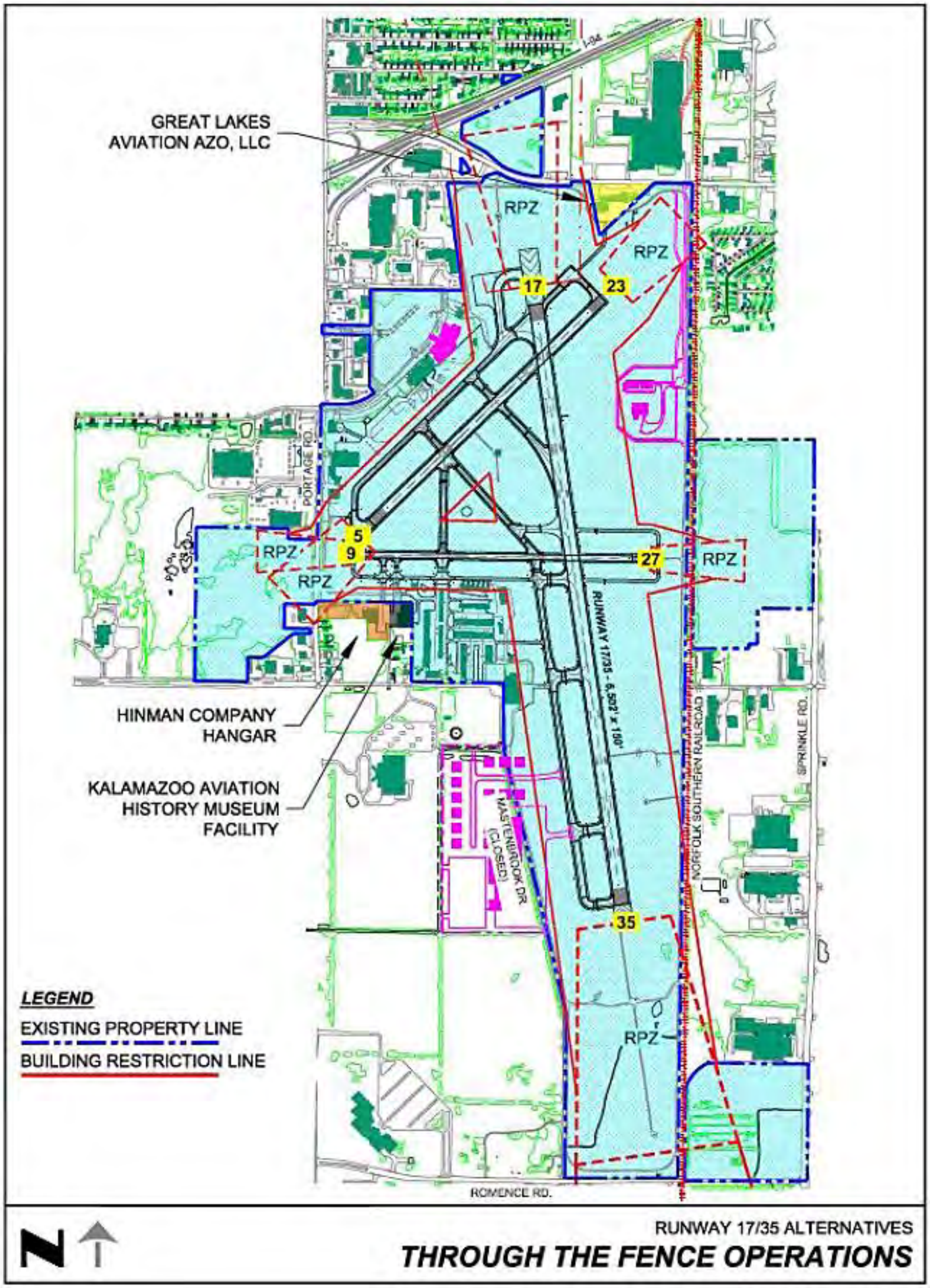
4.8.a Alternative 13 – Updating Access Agreements – Alternative 13 proposes reviewing and updating as needed existing access agreements between the Airport and tenants who conduct through the fence operations to reflect guidelines established by FAA AC 150/5190-7. These updated agreements are intended to comply with FAA guidelines that promote safety, protect Airport users from unauthorized access, prevent complication in the control of vehicle and aircraft traffic, and define the obligations of the tenant to uphold these standards.

- **Operational Factors –** Reviewing and updating access agreements ensures that these tenants conform to the same minimal standards expected from on-airport entities while minimizing conflicts with rights of access to the airfield. In meeting FAA recommendations, these revisions assure that the Airport meets Federal obligations in receiving grants, receives fair compensation for allowing airfield access, defines insurance requirements, and establishes procedures for default or termination of the agreement.

- **Economic Factors –** Review of the through the fence agreements ensures fair compensation is received for allowing this off-airport access, as is required from tenants located on Airport property. Financial terms negotiated in these agreements also serve as an additional source of revenue to operate and maintain the Airport's infrastructure.

- **Environmental Factors –** This alternative does not have any environmental impacts as no physical development is necessary for its implementation.

Figure 4-16
Locations of Through the Fence Operations



Source: Mead & Hunt, Inc.

- **Implementation Factors –** Failure to review and update as needed existing agreements may have several consequences for both the tenant and the Airport. Noncompliance with grant assurances as a result of inadequate agreements may reduce or halt Federal funding towards the maintenance and further development of Airport infrastructure. Compromises to controlled access to the airfield and security may result in significant violations and penalties to both the tenant and the Airport, resulting in revocation of operating certificates, fines, and civil infractions. Complications may also arise in the termination of the agreement or sale of the property to another tenant that may result in costly and timely court proceedings.

- **Summary – Table 4-13** summarizes the benefits and consequences of Alternative 13.

Table 4-13
Alternative 13 Summary – Updating Access Agreements

Benefits With Updated Agreement	Consequences Without Agreement
• Updates minimal standards • Minimizes access rights conflicts • Meets FAA recommendations • Ensures Federal obligations are met • Establishes payment provisions for access and use of infrastructure • Sets forth default and termination procedures • Identifies minimal insurance requirements	• Noncompliance with grant assurances • Compromises airfield safety and security • Potential legal complications as a result of termination of agreement or sale of property

4.8.b Alternative 14 – Future Inclusion of Properties – Alternative 14 proposes the Airport plan long-term to acquire the properties of the three tenants that conduct through the fence operations, should these parcels of land be made available for sale. It should be noted that this alternative does not propose the Airport seek to immediately purchase these properties, but rather plan for their inclusion when defining long-term property needs. Identification of this intent would be accomplished through the including the areas within the future property line in Airport Layout Plan (ALP) drawings.

- **Operational Factors –** Inclusion of these three properties on the ALP within the future property line qualifies them as eligible to receive federal funding, well-positioning the Airport for their acquisition when made available for sale. Acquiring these parcels eliminates this FAA discouraged method of airfield access and ensures the Airport is responsible for all access control and airfield security, reducing potential grant assurance and federal obligation conflicts.

  The addition of these properties on the ALP allows the operations of existing tenants to continue and does not revise, complicate, or alter any agreements or arrangements with the Airport. Inclusion also does not implement a timeline for the Airport to acquire the land nor does it suggest or state that existing tenants should begin planning for relocation. Instead, the intent is to establish a long-term plan that mitigates this type of discourage access to the airfield environment.

- **Economic Factors –** The purchase of these three parcels of land opens up an additional revenue source for the Airport as lease agreements could be negotiated with future tenants for their use. Ownership of the properties also helps reduce any potential complications towards receiving federal funds as that Airport would have full control over the assurances and obligations that must be met.

- **Environmental Factors –** No environmental impacts would result with the inclusion of these parcels of land as future Airport property on the ALP as no physical development would be necessary to implement this alternative.

- **Implementation Factors –** Though the implementation timeline to include these areas as future Airport property on the ALP drawing is relatively short, the actualization of their sale and purchase may take several years. As each of the three tenants offer services valuable to the aviation community while contributing to the Airport's economy, it is not logical to seek immediately acquisition of these properties. Pending the continued success of these businesses and their operating arrangements with the Airport and other tenants, the potential sale of these properties may not be available for an indefinite period of time.

- **Summary – Table 4-14** summarizes the advantages and disadvantages of including the properties with through the fence access on the Airport's ALP.

Table 4-14
Alternative 14 Summary – Future Inclusion of Properties

Advantages	Disadvantages
• Property acquisition eligible for federal funding • Ensures Airport control in meeting grant assurances and federal obligations • Eliminates FAA discouraged form of airfield access • Airport has full control over all access rights and enforcement of security • Eliminates potential complications in receiving Federal funding	• Lengthy timeline towards the available sale and acquisition of land

4.8.c Preferred Alternative – Alternative 13 proposes updating access agreements to strengthen Airport control on tenants that conduct through the fence operations. The high level of cooperation between the Airport and these property owners illustrate that renegotiation of more stringent agreements is not necessary. As such, the preferred alternative is Alternative 14, proposing the inclusion of these properties within the future boundary of the Airport on its ALP. This allows federal funds to be used in acquiring these properties should they become real estate for sale on the open market. This does not imply the Airport is seeking the immediate acquisition of these properties; rather, it identifies them in the long term property plans of the Airport, helping to address this type of airfield access that is discouraged by the FAA.

4.9 Use of Former Terminal Building

In April 2011, construction was completed on the new terminal and all commercial airline operations and related services were relocated to the new building. Through 2013, air traffic control operations will remain in the former terminal until completion of the new control tower and approach control facility, located on the east side of the airfield. With the exception of air cargo operations, the former terminal building will be vacant. Therefore, future use of this building was evaluated as part of the facility requirements. Development options for this area of land were analyzed to determine how to most effectively use this valuable space within the constrained terminal area. The following alternatives measure the benefits and deficiencies of retaining the former building or clearing the structure for additional development opportunities.

4.9.a Alternative 15 – Retain Former Terminal Building – This alternative proposes retaining the former terminal building for future aeronautical or non-aeronautical uses. Though renovation of the building may be necessary to expand or contract its size, the majority of the structure would remain at its current location.

- **Operational Factors –** Retaining the building provides an opportunity to increase Airport revenue though lease of the building to aeronautical or non-aeronautical tenants. The building's proximity adjacent to the terminal ramp area serves as an ideal location for a fixed base operator (FBO), air cargo forwarder, or aircraft maintenance facility. Conversion of the building into offices, a business park, or light industrial/commercial use is a non-aeronautical option for the facility. Its location near the terminal, FBO, Portage Road, and I-94 are attractive features that may be desired by some businesses.

- **Economic Factors –** Through lease of the building, the Airport will have another mechanism to generate revenue through monthly rent collected from future tenants. Any renovation, expansion, or reduction of the building would contribute to development costs in converting the building for tenant use. It should be noted that the Airport will incur additional expenses to keep the building operational that may constrain its budget during periods of vacancy when revenue is not being collected for its use.

- **Environmental Factors –** As some elements of the building's structure were constructed in 1958, any renovation would need to guard against exposure to asbestos or other harmful construction materials typically used in building construction practices of the day. Additional impacts to air and water quality, habitats, species, or other socio-economic impacts are not anticipated

- **Implementation Factors –** With the building's proximity to the terminal building, coordination with FAA and Transportation Security Administration (TSA) officials will be necessary reduce the impact of construction activities on aircraft operations and Airport security procedures. Conversion of the building for aeronautical uses will also require coordination with the TSA to delineate security areas for passenger, air cargo, and other high-profile aviation activities.

  It should be noted that implementation of this alternative will constrain future expansion of the terminal to the southwest as it was designed to be expanded in this direction. Retaining the former terminal also would limit available area for future terminal area development opportunities such as increased vehicle parking and a rental car QTA facility.

  Retaining the former terminal also will impact the visual appeasing elements of the entrance road leading up to the new terminal. Its location prior to the terminal along the entrance service road obstructs the view of the new building when seen turning off of Portage Road. The former terminal's location also may confuse passengers on which building they should enter or park near if seeking commercial passenger airline service.

- **Summary – Table 4-15** summarizes the review of factors for Alternative 15 to retain the former terminal building.

Table 4-15
Alternative 15 Summary – Retain Former Terminal Building

Advantages	Disadvantages
• Direct access to airfield • High visibility location • Opportunity to increase Airport revenue • Can be converted for both aeronautical and non-aeronautical uses • Proximity to terminal/FBO attractive for businesses dependent upon air transportation	• Constrains terminal expansion to the southwest • Limits room for terminal area developments • Continued maintenance costs • Limits visibility of terminal • May increase passenger confusion on which building commercial airline operations occupy

4.9.b Alternative 16 – Demolition of Former Terminal – Alternative 16 proposes demolition of the former terminal building and utilizing the area for future development opportunities such as expansion of vehicle parking or construction of a rental car QTA facility. **Figure 4-17** illustrates the terminal area and area of land that would be available if the former building was removed.

- **Operational Factors –** Removal of the former building would open up approximately 2 acres of land in proximity of the terminal area for development. As available space is constrained in the terminal area, an additional 2 acres of land could accommodate additional parking, rental car facilities, or other aeronautical or non-aeronautical development opportunities. As initial long term plans for the new terminal allow for expansion to the southwest, removal of the former building would further facilitate this opportunity when additional capacity is necessary.

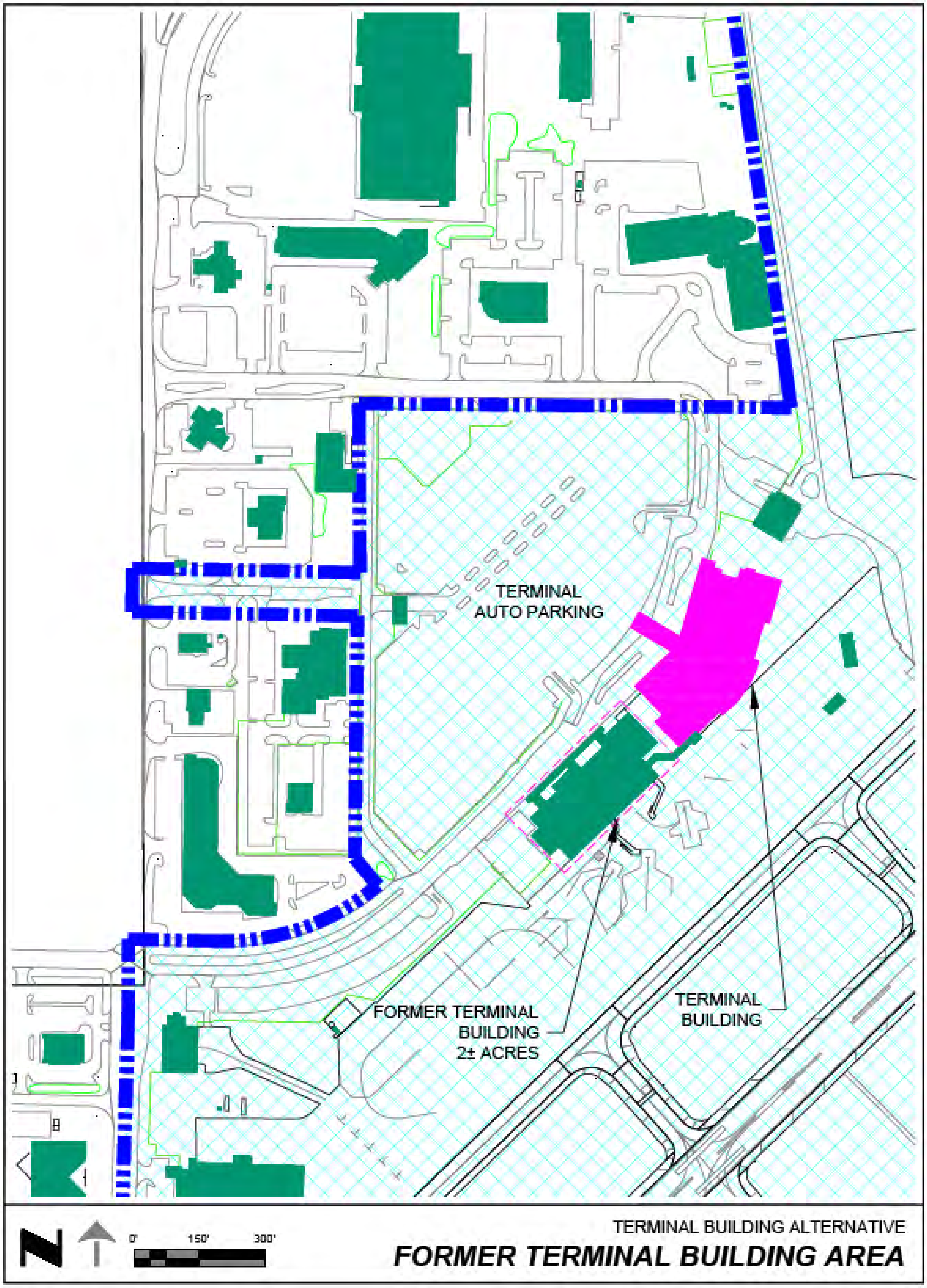
- **Economic Factors –** Removal of the former terminal eliminates the Airport operational expense necessary to maintain the building while providing an opportunity to increase revenue. Future developments that could occur on this area of land would contribute to additional Airport income through leases and rent agreements that would be negotiated with future tenants.

- **Environmental Factors –** No significant environmental impacts are anticipated with removal of the former terminal building as no changes to air and water quality, habitats, or impacts to socio-economic factors will occur. Demolition activities will require the use of best practices to guard against asbestos or other harmful construction material exposure that may be present.

- **Implementation Factors –** Coordination with FAA and TSA officials will be necessary to reduce the impact of demolition activities on aircraft operations and Airport security. The potential of harmful construction materials that could be exposed during the demolition may increase project delays as a result of special procedures that may be required for the removal of these materials. Additional project delay also may be experienced if any historic or pre-historic artifacts are found in the removal of materials from the site, as coordination with the Michigan State Historic Preservation Office (SHPO) will be necessary.

- **Summary – Table 4-16** summarizes the review of factors in removing the former terminal and opening up the area for future development.

Figure 4-17
Terminal Area



Source: Mead & Hunt, Inc.

Table 4-16
Alternative 16 Summary – Demolition of Former Terminal

Advantages	Disadvantages
• Approximately two acres of land for future terminal area development • Room to expand terminal building • Available land for additional parking or rental car QTA facility • Reduces Airport operational and maintenance expenses • Opportunity to increase Airport revenue • Visually enhances the terminal area	• Removal of existing infrastructure for aeronautical or non-aeronautical uses • Potential projects delays experienced if harmful construction materials or historical artifacts are uncovered during demolition

4.9.c Preferred Alternative – Several options justify the renovation or demolition of the former terminal building since all commercial airline operations were transferred to the new building in 2011 and air traffic control operations will be relocated to the new control tower/approach control facility in 2013. Both options represent feasible opportunities to effectively utilize this area, ranging from Airport improvements such as additional parking, a rental car quick turnaround facility, aeronautical use as an FBO, air freight forwarding operation, or a non-aeronautical related office building. As the number of development options is limitless, it is recommended the Airport pursue Alternative 15 that proposes the building be retained until a more defined use of this area is established. This option gives the Airport flexibility when evaluating proposals to decide on how to most effectively utilize this area. Once an ideal developmental option has been identified, the building can then be demolished or renovated as needed.

4.10 Parking

As noted in the review of facility requirements, parking demand is anticipated to increase over the next twenty years. **Tables 4-17, 4-18,** and **4-19**, respectively, review projections through 2030 for public long term, rental car, and employee parking. **Table 4-20** summarizes the total projected parking demand through the planning period. It should be noted that between 1990 and 1999 demand for parking was greater than current levels as enplanements fluctuated between 250,000 and 280,000. As the worldwide economy rebounds throughout the planning period and enplanements return to levels experienced prior to the last decade, a high growth scenario has been included to review parking needs should passenger levels exceed anticipated forecasts. The following sections review alternatives to accommodate the parking demands of all users at the Airport.

Table 4-17
Review of Public Long Term Parking Projections

Year	Enplanements	Peak Spaces Occupied	Spaces per 1,000 Enplanements	Parking Spaces Required	Existing Long-Term Lot Spaces	Additional Spaces Required / (Surplus)
			Historical			
2008	166,986	948	5.6771	1,185	1,322	(137)
2009	139,712	717	5.1320	896	1,322	(426)
			Projected			
2015	144,623	821	5.6771	1,026	1,322	(296)
2020	164,286	933	5.6771	1,166	1,322	(156)
2025	185,862	1,055	5.6771	1,319	1,322	(3)
2030	209,100	1,187	5.6771	1,484	1,322	162
			High Growth Scenario[1]			
2030	280,000	1,590	5.6771	1,987	1,322	665

Note: [1]Enplanements fluctuated between 250,000 and 280,000 in the 1990s. The high growth scenario examines parking requirements for 280,000 enplanements.
Projections: Mead & Hunt, Inc.

Table 4-18
Review of Rental Car Parking Projections

	Current Need			Future Requirements (2020)		
	Ready/Return Spaces	Long-term Storage Spaces	Total Spaces	Ready/Return Spaces	Long-term Storage Spaces	Total Spaces
Vendor 1	70	0	70	90	0	90
Vendor 2	40	50	90	60	75	135
Vendor 3	54	30	84	81	45	126
Total	164	80	244	231	120	351

Source: Rental car vendors

Table 4-19
Review of Employee Parking Projections

Year	Enplanements	Employee Spaces Occupied	Spaces per 1,000 Enplanements	Existing Employee Lot Spaces	Additional Spaces Required / (Surplus)
Historical					
2009	139,712	77	0.5511	110	(33)
Projected					
2015	144,623	80	0.5511	110	(30)
2020	164,286	91	0.5511	110	(19)
2025	185,862	102	0.5511	110	(8)
2030	209,100	115	0.5511	110	5

Projections: Mead & Hunt, Inc.

Table 4-20
Summary of Total Parking Projections

Year	Long Term Parking Demand	Employee Parking Demand	Total Rental Car Storage & Ready/Return Demand	Total Demand	Total Existing Parking Capacity	Total Spaces Required (Surplus)
Historical						
2009	896	77	244	1,217	1,600	(383)
Projected						
2015	1,026	80	244	1,350	1,600	(250)
2020	1,166	91	351	1,608	1,600	8
2025	1,319	102	351	1,772	1,600	172
2030	1,484	115	351	1,950	1,600	350
2030*	1,590	115	351	2,056	1,600	456

Note * = Long term parking high growth scenario
Projections: Mead & Hunt, Inc.

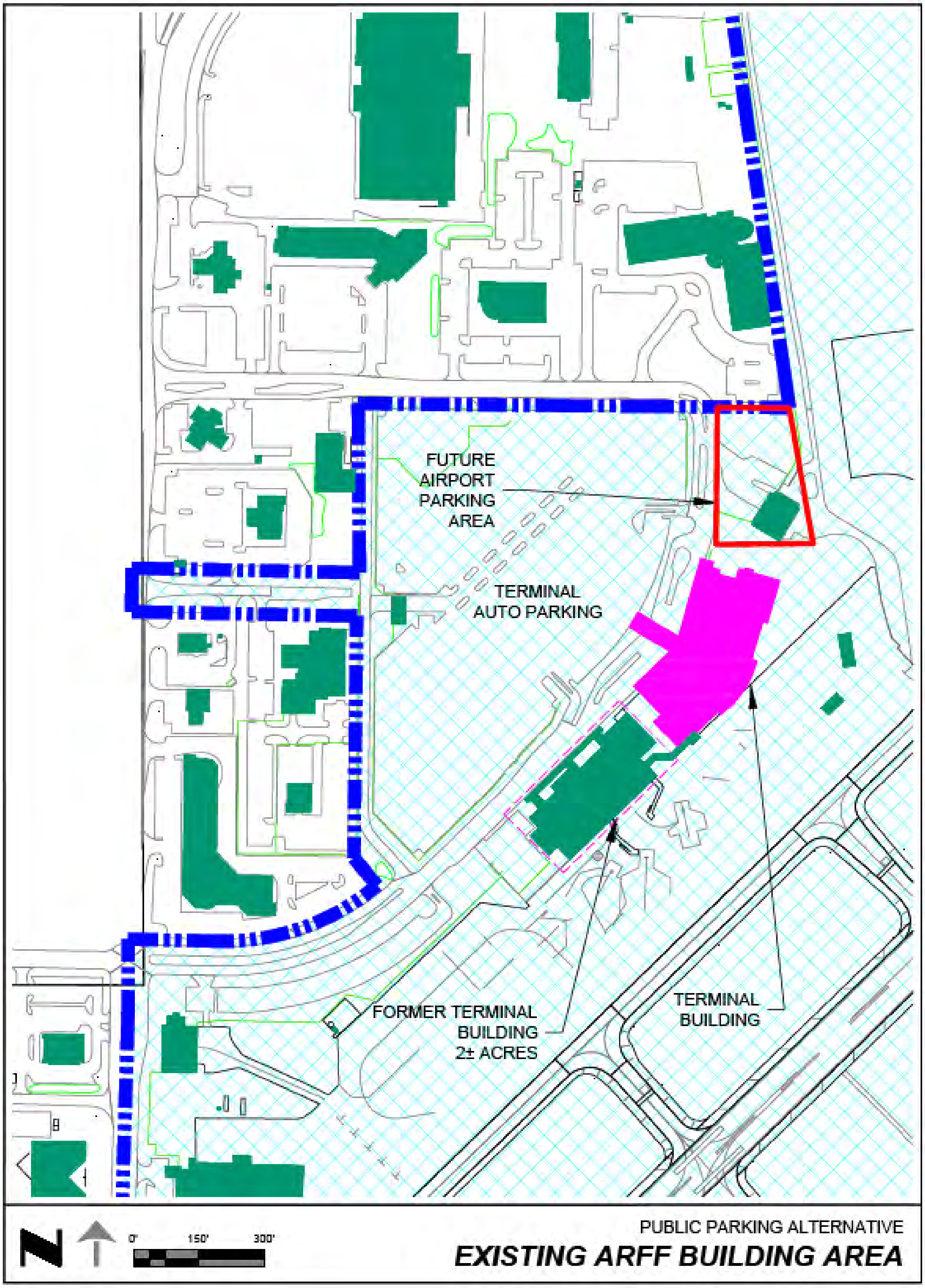
4.10.a Alternative 17 – Existing ARFF Building Area – Following construction of a consolidated ARFF/SRE facility, the land adjacent north of the terminal will be available for development after ARFF services are relocated to the new building. Alternative 17 proposes using the 1.3 acres of available land to expand existing parking capacity. **Figure 4-18** illustrates the designated area for this alternative.

- **Operational Factors –** Advantages of this alternative include additional parking capacity that would be available in close proximity to the terminal building, requiring no acquisition of additional land. An estimated additional 126 parking spaces could be made available to ideally meet public short term or rental car needs. Use of this area could also incorporate a consolidated rental car QTA facility, allowing service and maintenance to take place on Airport property, reducing the amount of time needed to prepare returned vehicles for the next customer. **Figure 4-19** illustrates an example layout that could incorporate a QTA and provide approximately 100 vehicle parking spaces.

- **Economic Factors –** Costs incurred to implement this alternative include time and materials to design and construct the parking lot and demolish the existing ARFF building. Assuming parking lot construction costs are $2,000 to $2,500 per surface space, initial estimated costs for a 126 space lot range from $252,000 to $315,000.

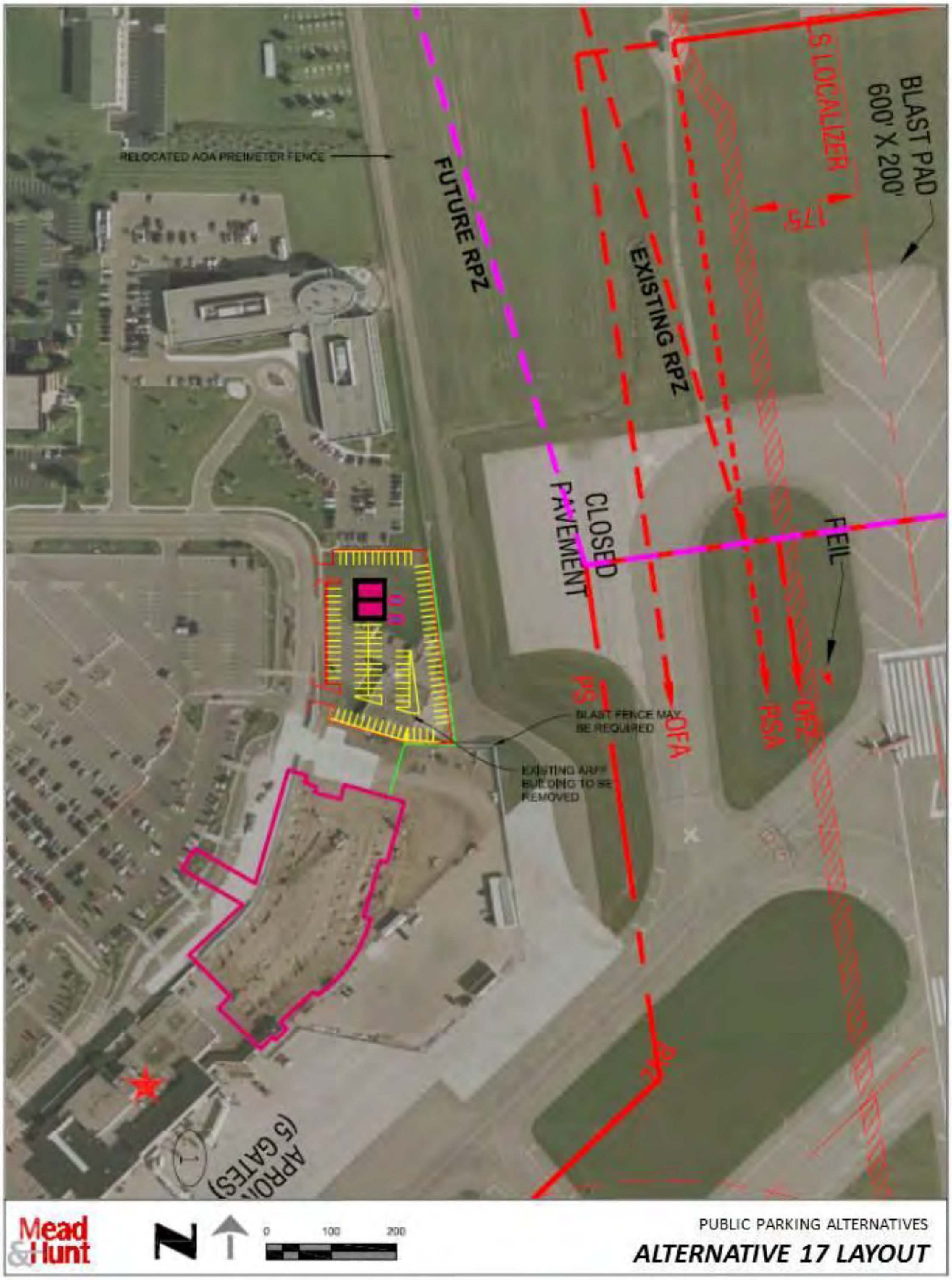
- **Environmental Factors** – Initial review of Michigan DNRE and U.S. Fish and Wildlife Service databases indicated no wetlands, habitats, or threatened and endangered species are present within the proposed area of development. No other significant environmental impacts are anticipated as development activities that would occur in areas that have been previously disturbed by construction activities.

Figure 4-18
Alternative 17 – Existing ARFF Building Area



Source: Mead & Hunt, Inc.

Figure 4-19
Alternative 17 with Rental Car QTA Facility



Source: Mead & Hunt, Inc.

- **Implementation Factors –** Several factors impact this alternative's feasibility towards meeting forecasted parking demand. The additional 126 parking spaces gained through this development option are not sufficient to meet all forecasted Airport parking demands. The location is also not contiguous to existing public parking, requiring additional resources for revenue control or infrastructure improvements to join the area with the existing lot if used as public parking. Proximity to the terminal also limits future northward expansion of the building to meet long-term demand. Use of the site solely for parking also limits available locations for an on-airport consolidated rental car quick turnaround facility.

- **Summary – Table 4-21** summarizes the findings from factor review for implementation of this alternative.

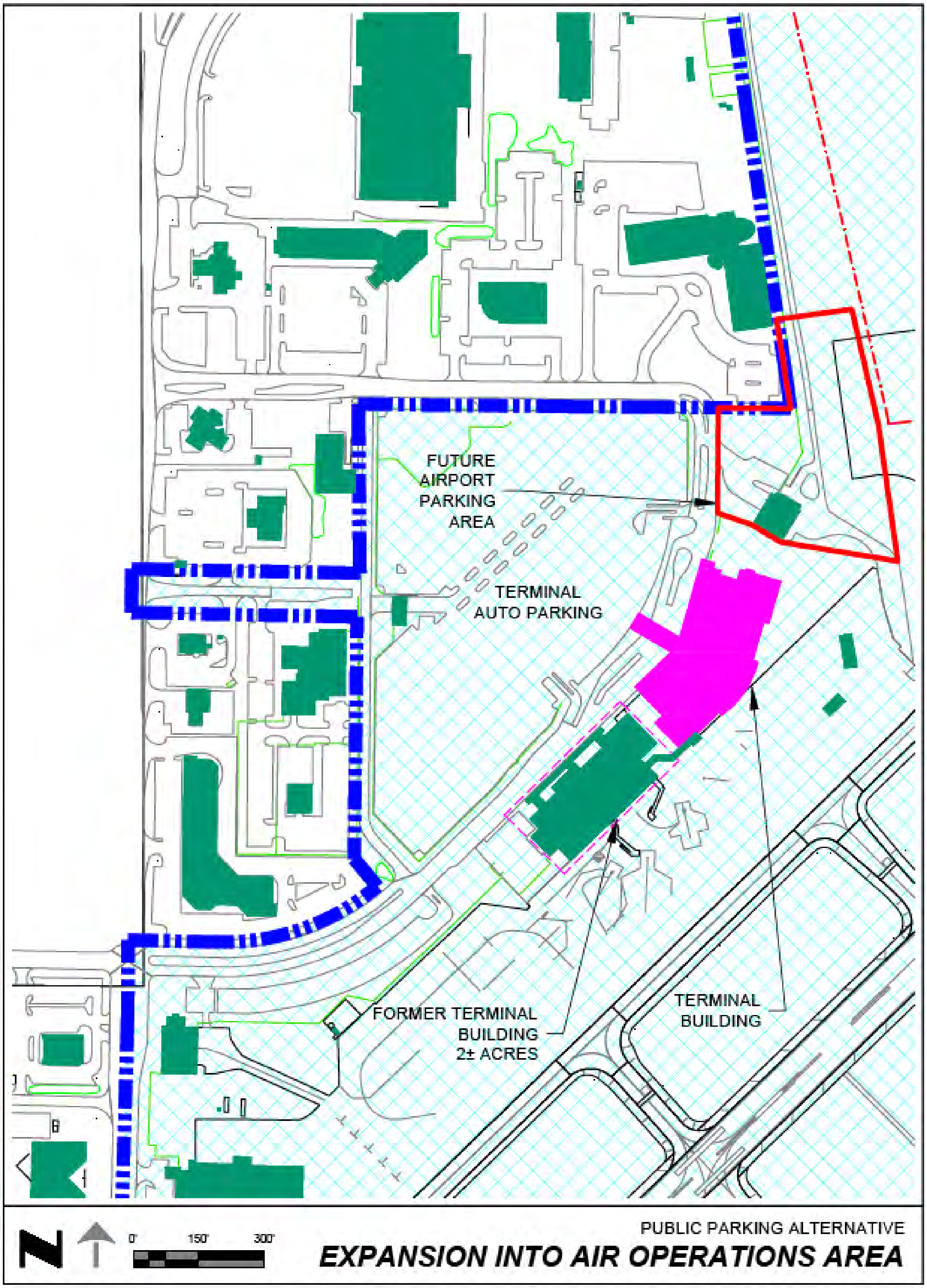
Table 4-21
Alternative 17 Summary – Existing ARFF Building Area

Advantages	Disadvantages
• No land acquisition required • Adjacent to terminal	• Limits northern expansion of terminal • Approximately 1.3 acres • Additional 126 parking spaces • Not contiguous to existing public parking • Does not meet future parking demands

4.10.b Alternative 18 – Air Operations Area (AOA) – Alternative 18 proposes utilization of land occupied by the existing ARFF building and decommissioned airfield surfaces to the east. Removal of the existing ARFF facility and a decommissioned aircraft holding pad within the Air Operations Area (AOA) would be required to provide an additional 3.5 acres of land for development. **Figure 4-20** illustrates this area as proposed by Alternative 18.

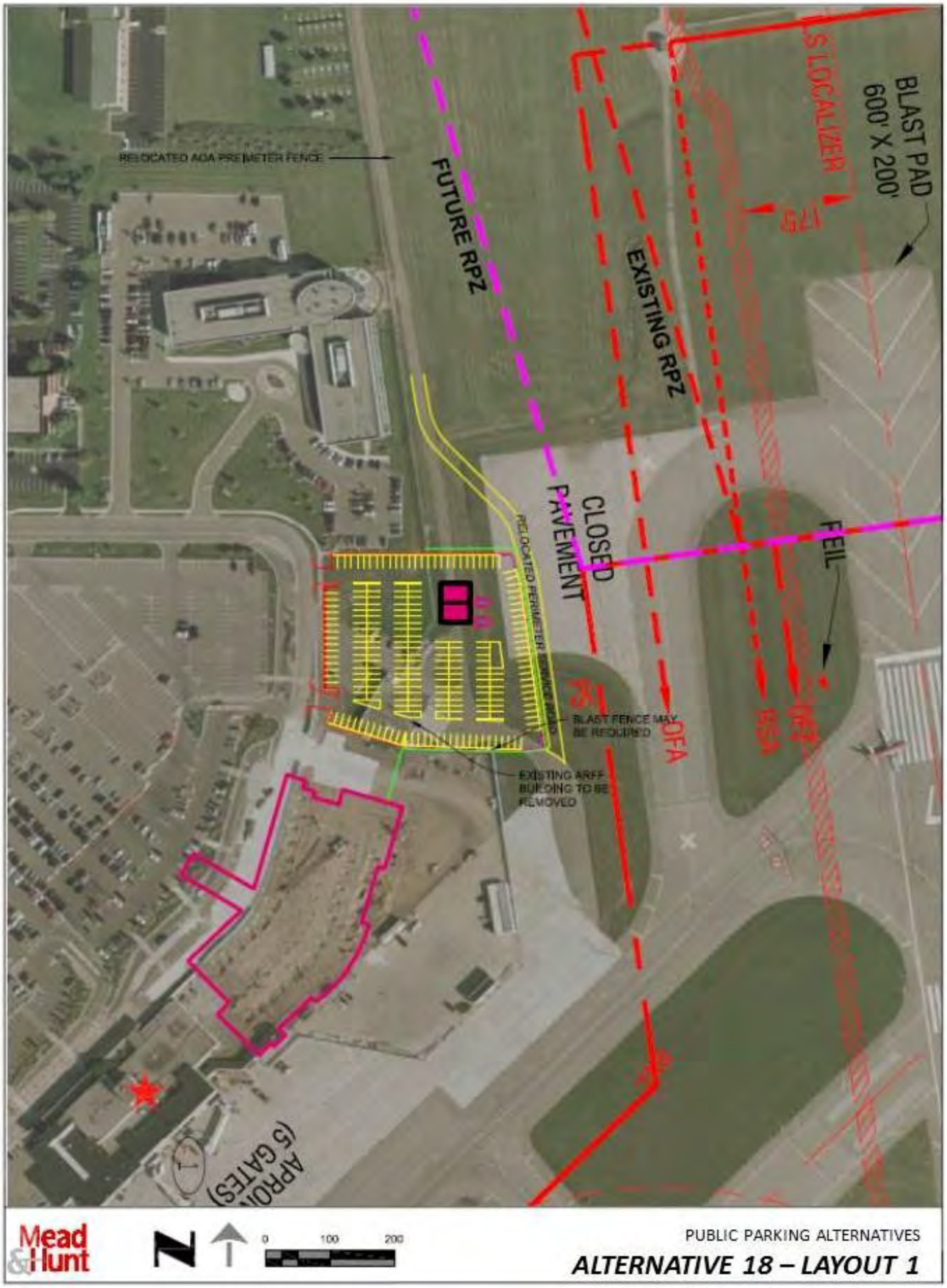
- **Operational Factors –** No acquisition of land would be required to implement this alternative, utilizing land adjacent to the terminal. The convenience of this area in proximity to the terminal could be developed to provide an additional 340 parking spaces or 216 parking spaces with a rental car QTA facility layout as illustrated in **Figure 4-21** or 236 parking spaces as shown in **Figure 4-22**. With a rental car QTA facility, this alternative would sufficiently meet the ready/return parking needs of the rental car agencies, but would be unable to meet rental car storage demands. Development of the area without a rental car QTA facility would be required to meet both ready/return and storage parking demands.

Figure 4-20
Alternative 18 – Air Operations Area



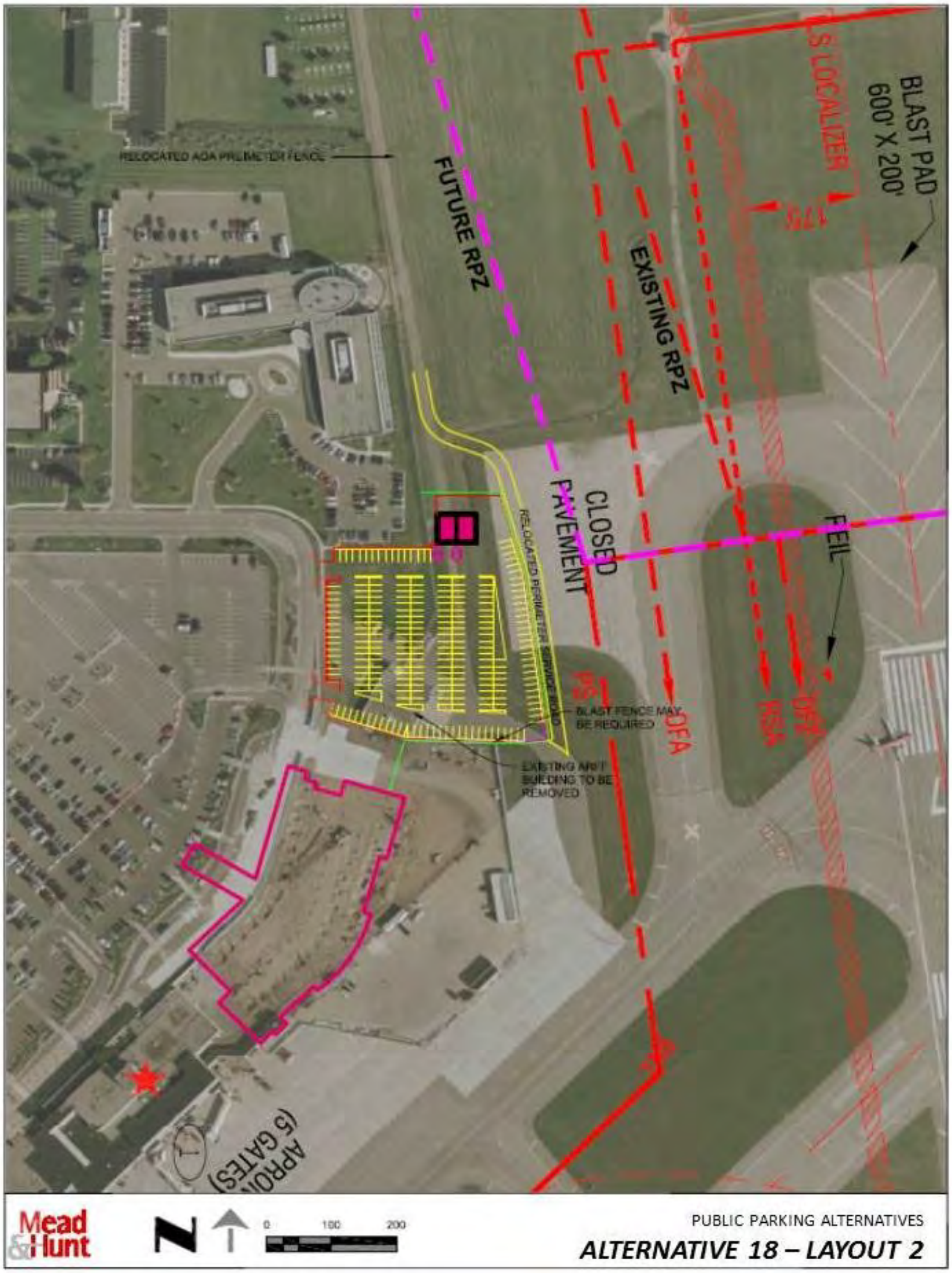
Source: Mead & Hunt, Inc.

Figure 4-21
Alternative 18 with Rental Car QTA Facility – Layout 1



Source: Mead & Hunt, Inc.

Figure 4-22
Alternative 18 with Rental Car QTA Facility – Layout 2



Source: Mead & Hunt, Inc.

- **Economic Factors –** Assuming an estimated cost of $2,000 to $2,500 per surface space, estimated cost to construct a 340 space lot is $680,000 to $850,000. Additional costs would be incurred for demolition of the existing ARFF building, necessary earthwork, utility infrastructure improvements, removal of the decommissioned aircraft holding pad, realignment of the interior airfield perimeter access road and construction of the rental car QTA building.

- **Environmental Factors –** No significant environmental impacts are anticipated with implementation of this alternative as most development would occur on land currently occupied by existing Airport infrastructure. All construction activities would in accordance to Federal, State, and local regulations using industry best practices.

- **Implementation Factors –** The implementation of this alternative will be dependent upon approval from the FAA to convert a portion of the AOA for non-aeronautical purposes. Justification would need to be demonstrated on the necessity of this area for parking expansion and its limited existing and future aeronautical use. This location also would limit future expansion of the terminal building to the north and require installation of additional revenue control resources as a result of it being discontinuous with the existing public parking area, if used for public parking. Though this alternative would be capable of meeting the forecasted additional parking requirements of the rental car agencies for ready/return parking with a QTA facility, it would not meet the all future vehicle parking requirements.

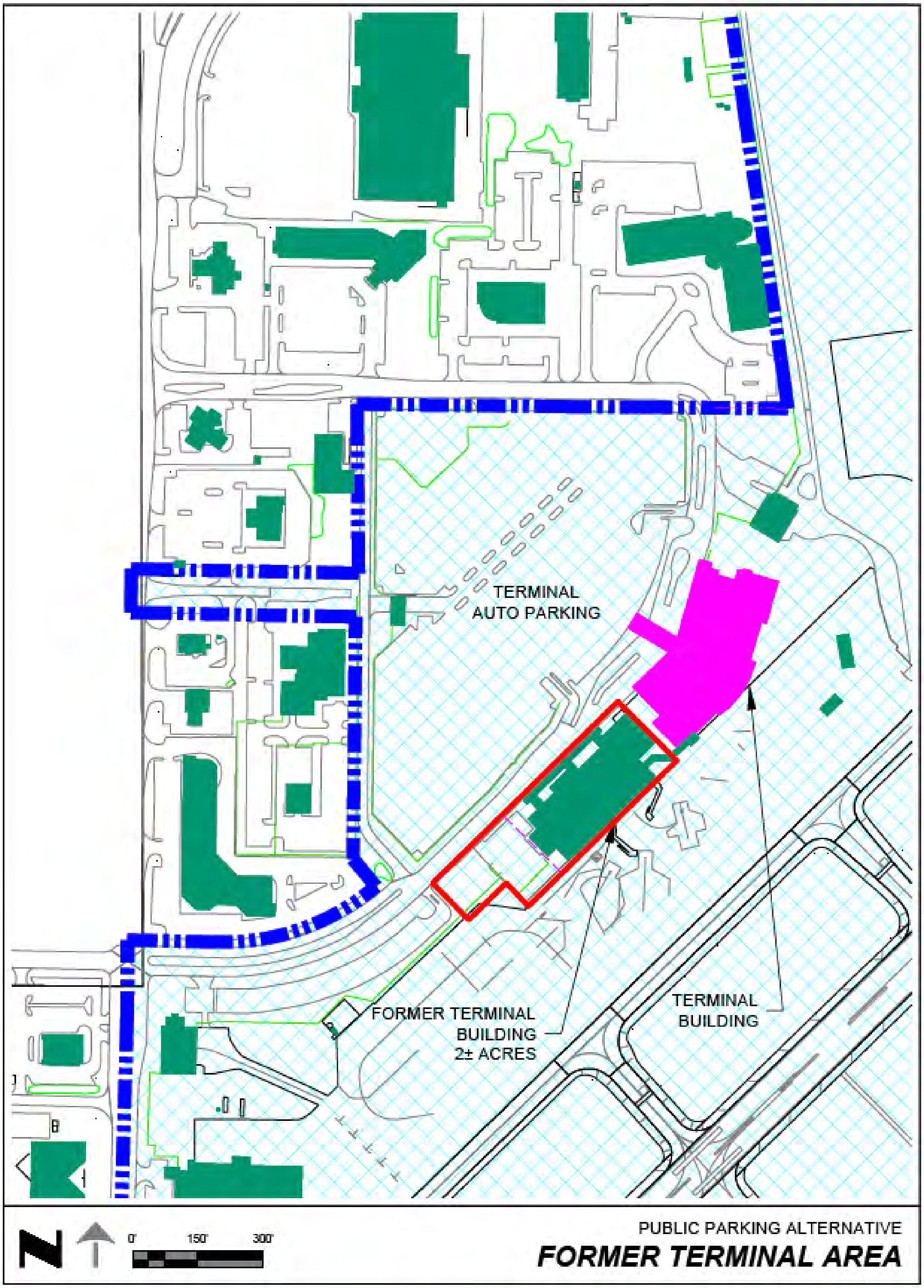
- **Summary – Table 4-22** summarizes the review of factors towards utilization of this area for future parking expansion as proposed by Alternative 18.

Table 4-22
Alternative 18 Summary – Air Operations Area

Advantages	Disadvantages
• No land acquisition required • Located adjacent to terminal • Approximately 3.5 acres of land available • Provides an approximate 340 parking spaces (or 236 spaces with rental car QTA facility) • Meets demand for rental car parking and facilities	• Limits northern expansion of terminal • FAA approval required to conversion of AOA land for non-aeronautical purposes • Not contiguous with existing public parking • Does not meet all future parking demands

4.10.c Alternative 19 – Former Terminal Area – Alternative 19 proposes expansion of parking facilities onto approximately 2.1 acres of land currently occupied by the former terminal building. Demolition of the building would be required to implement this alternative. **Figure 4-23** illustrates the proposed area for Alternative 19.

Figure 4-23
Alternative 19 – Terminal Area



Source: Mead & Hunt, Inc.

- **Operational Factors –** Advantages of this alternative include the use of existing Airport property and its close proximity to the new terminal building. The proposed area's location near the terminal and the main Airport entrance positions it well for an expansion of the existing employee lot as well as use for a rental car return area and additional short-term public parking.

- **Economic Factors –** Initial cost estimates to construct a 203 space lot on approximately 2.1 acres of land is estimated at $406,000 to $507,500. Additional project expenses would be incurred for the removal of the former terminal building and any other additional infrastructure improvements such as utility relocation, installation of drainage, and changes to the Airport entrance road to include entrances and turn lanes.

- **Environmental Factors –** No significant environmental impacts are anticipated with implementation of this alternative because all development would occur on land previous disturbed for infrastructure improvements. It should be noted that the location of the Airport was the site of a large Native American Potawatomi village with the location of a former tribal burial ground southwest of the former terminal building. Though all known human remains have been removed, care should be given to any excavation or earthwork that should occur on the proposed alternative's site. Any found artifacts or items of historical value would require the notification of the Michigan Office of the State Archaeologist, Michigan SHPO, and appropriate federally recognized Native American THPOs.

- **Implementation Factors –** Though its proximity to the Airport entrance road and terminal building would be a convenience to travelers, the approximate 203 spaces that could be added on the 2.1 acre site would not be sufficient to meet all future parking demands. The location is not contiguous to existing public parking, and thus would require additional revenue control mechanisms. The location also limits expansion of the terminal building to the southwest and other development opportunities in proximity of the terminal area, including a consolidated rental car QTA facility.

- **Summary – Table 4-23** summarizes the advantages and disadvantages of developing the former terminal building site to expand parking capacity.

Table 4-23
Alternative 19 Summary – Former Terminal Area

Advantages	Disadvantages
• No land acquisition required • Located adjacent to terminal	• Limits southern expansion of terminal • Approximately 2.1 acres of land • Additional 203 parking spaces • Not contiguous to existing parking • Does not meet all future parking demands

4.10.d Alternative 20 – Land Acquisition – Acquisition of two parcels of land adjacent to Airport property off Fairfield Road is proposed by Alternative 20 to expand parking capacity. Approximately 0.9 acres of land to the south of Fairfield Road formerly occupied by D.L. Gallivan, Inc. and 3.1 acres to the north occupied by the closed Lee's Inn hotel would be utilized to expand the existing public parking lot. **Figure 4-24** identifies the locations of these two parcels of land.

- **Operational Factors –** This alternative expands parking capacity while retaining land near the terminal for other development opportunities, including future expansion of the building and a rental car QTA facility. Acquisition of additional property increases the footprint of the Airport and assists in controlling surrounding compatible land uses. The additional 4.0 acres of land for parking would result in an additional 387 parking spaces.

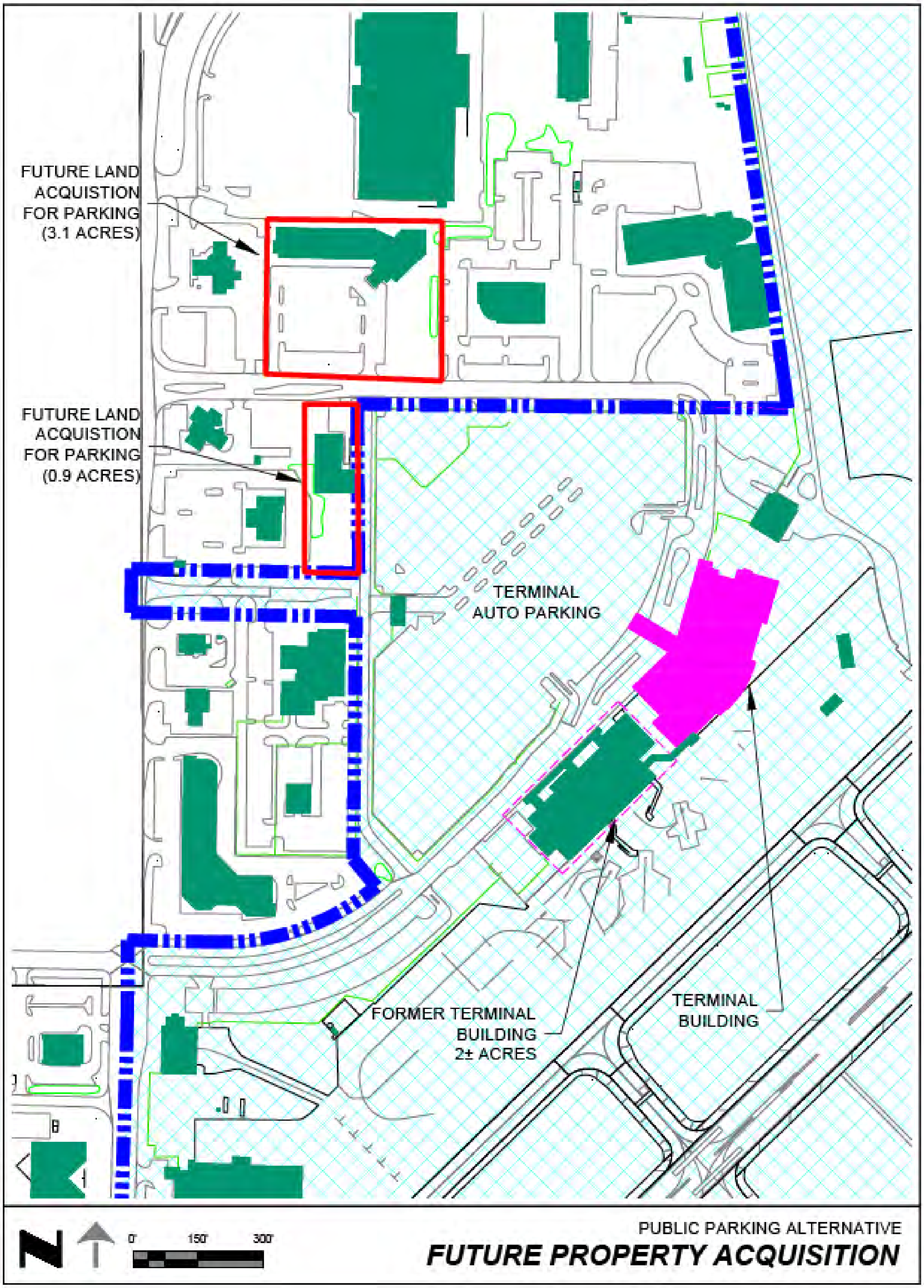
- **Economic Factors –** Estimated cost to construct an additional 387 surface lots assuming $2,000 to $2,500 per space is projected at $774,000 to $967,500. Additional cost would be incurred for the purchase of the land, demolition of existing structures, and infrastructure improvements to such items as utilities and Airport access road network.

- **Environmental Factors –** No significant environmental impacts are anticipated with implementation of this alternative. Initial review of Federal and State resources indicate no wetlands or habitats of endangered or threatened species are located within the designated development areas. A detailed environmental review to measure any potential impacts will be necessary to verify these initial findings before any development activities would occur.

- **Implementation Factors –** Though additional parking spaces would be made available, this alternative is unable to meet the total projected parking demand of an additional 167 spaces by 2030, using conservative projections. If greater demand is realized as projected by the high growth scenario, a deficiency of up to 667 spaces would be experienced. The acquisition of land and additional infrastructure improvements such as the installation of revenue control mechanisms and improvements to Fairfield Road and the parking lot access drive would also be necessary to implement this alternative. The distance of these areas to the terminal building is also a factor impacting feasibility as the lengthy walking distance would not be convenient for most passengers. The use of shuttle buses to transport passengers to and from these lots would increase congestion in front of the terminal and lengthen a passenger's time connecting between their vehicle and the terminal building.

- **Summary – Table 4-24** summarizes the review of factors for Alternative 20.

Figure 4-24
Alternative 20 – Land Acquisition



Source: Mead & Hunt, Inc.

Table 4-24
Alternative 20 Summary – Land Acquisition

Advantages	Disadvantages
• Development areas near terminal remain available for building expansion • Increases footprint of Airport property • Approximately 4.0 acres of land available • Provides an approximate 387 additional parking spaces	• Land acquisition required • Lengthy walking distance to terminal • Not contiguous to existing public parking

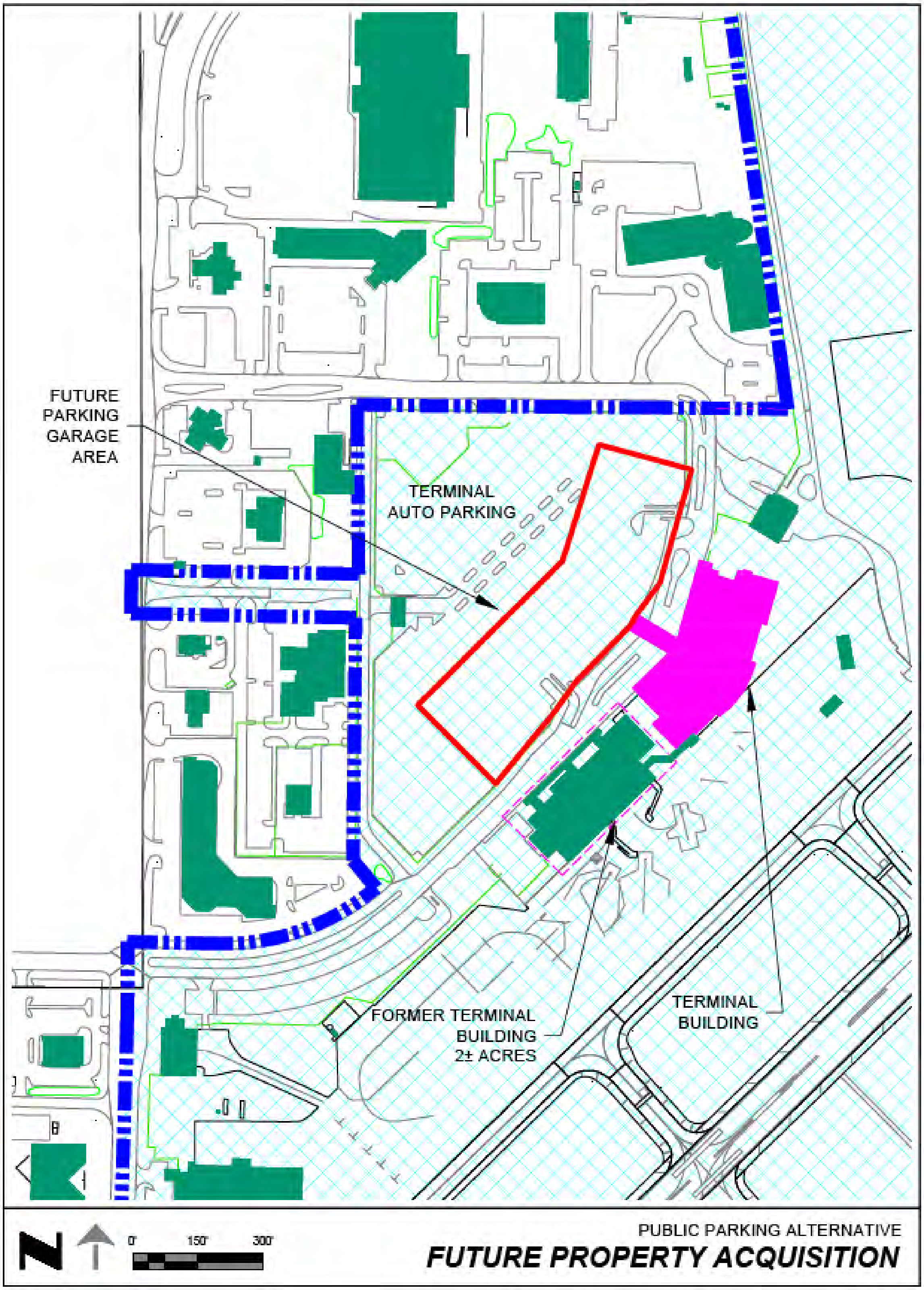
4.10.e Alternative 21 – Parking Garage – Alternative 21 proposes construction of a parking garage on the site of the existing public parking lot adjacent to the terminal building. The dimensions for the structure would vary based on level of funding and anticipated demand but a size suggested for this alternative is approximately 725 feet in length and 225 feet in width. **Figure 4-25** identifies a proposed site plan for the location of a parking garage.

- **Operational Factors –** Construction of a parking garage offers an alternative to expand parking capacity without the need to acquire additional land. Development areas near the terminal could remain available for future building expansion while needed facilities such as a rental car QTA area could be incorporated into the structure. Proximity to the terminal building offers close, convenient parking options for passengers while integration with the canopy would provide sheltered access to vehicles.

  A parking structure could double or triple capacity at the Airport, exceeding anticipated demand throughout the planning period. A three-story structure with 163,125 square feet per level could provide upwards to an additional 1,000 parking spaces, well-positioning the Airport to meet longer term parking demands or greater than anticipated growth.

- **Economic Factors –** A factor impacting the feasibility of this alternative is its significant cost, estimated between $12 million to $15 million for a three-story, 1,000-space parking structure. Additional cost would be incurred for site preparation such as the removal of existing pavement, lighting, and utilities. During construction, the revenue generated from public parking would be temporarily reduced as a large portion of the lot would be closed.

Figure 4-25
Alternative 21 – Parking Garage



Source: Mead & Hunt, Inc.

- **Environmental Factors –** No significant environmental impacts are anticipated with implementation of this alternative as construction would occur on the site of an existing parking lot. Temporary impacts to air quality may result due to construction equipment, though any changes in local air quality are anticipated to be minor. All construction activities would follow industry best practices to mitigate any potential air or water quality impacts as a result of storm water drain off that may result.

- **Implementation Factors –** As noted in the review of economic factors, the significant cost to construct a parking structure is an impact towards the feasibility of this alternative. Traditional planning calls for parking structures to be considered when enplanements reach approximately 1,000,000 passengers. As forecasted enplanements are not anticipated to reach this level throughout the planning period, additional justification may be necessary to demonstrate the need for this facility. Although this alternative presents a solution that expands parking capacity without the acquisition of land or use of available development areas adjacent to the terminal, the cost benefit of such a structure to meet a projected need of an additional 350 spaces may not be logical.

  It should also be noted that during the construction phase of this alternative, temporary closure of the short-term lot and a significant portion of the long- term lot would be necessary. This would impact short- and long-term parking as parking spaces in close proximity of the terminal, contributing to passenger inconvenience. The temporary reduction in parking capacity as a result of construction also may also not allow the Airport to meeting parking demand, thus potentially stranding passengers seeking to park their vehicle on-airport. At the time of this master plan study, no off-Airport facilities provided vehicle parking that could accommodate this temporary reduction in available spaces.

- **Summary – Table 4-25** summarizes the advantages and disadvantages for construction a parking garage to meet the long-term parking needs of the Airport.

Table 4-25
Alternative 21 Summary – Parking Garage

Advantages	Disadvantages
• No land acquisition required • Development areas near terminal remain available for building expansion • Can incorporate other terminal area development into structure • Parking capacity could double or triple based on size of garage • Meets all future parking demands • Short walking distance to terminal	• Significant cost for construction ($12 million to $15 million) • On-airport parking limited during construction • Temporary parking inconveniences during construction

4.10.f Preferred Alternative – A combination of alternatives is necessary to address the future parking demands of the Airport as a result of limited areas for development in proximity of the terminal building. Future relocation of the existing fire station opens up an ideal area adjacent to the building to expand rental car parking. Though use of the area within the existing footprint of the station as proposed by Alternative 17 does not provide sufficient space, expansion into the AOA as proposed by Alternative 18 offers additional land to expand parking and accommodate a future rental car QTA facility. As a result, Alternative 18 is the preferred alternative to meet future rental car ready/return parking demand through the planning period.

Alternative 20 is the most feasible and cost effective option of the remaining alternatives to add additional long-term parking for the general public that does not require construction of a parking garage or significant improvements to existing infrastructure. Parking lots found on both properties help contribute to a lower level of site preparation that would be necessary to convert these areas for additional parking. Not only would the acquisition of two properties along Fairfield Road provide areas for additional parking, it also helps the Airport control surrounding compatible land uses. As a result of these justifications, Alternative 20 is the preferred development option to increase public long-term parking and rental car storage.

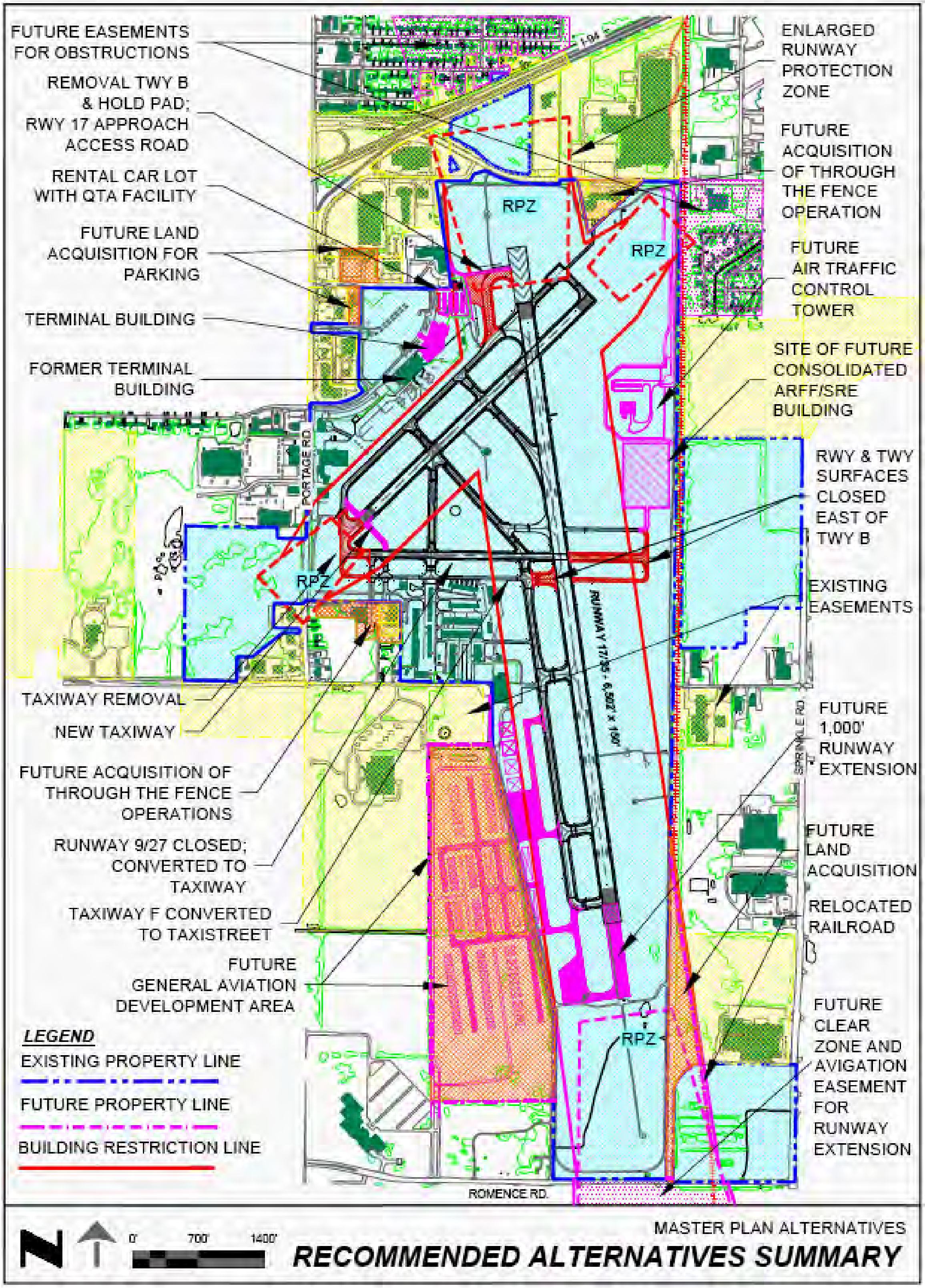
Use of land within the area of the former terminal building as proposed by Alternative 19 is the preferred alternative to increase available employee vehicle parking. Although development of the entire approximate 2.1 acre site is not necessary, use of a portion of this land would increase parking adjacent to the existing lot while helping to position the lot closer to the new terminal building. This area could also be utilized for the development of a cell phone waiting lot to allow vehicles a location to park while waiting to pick up arriving passengers. A cell phone lot could be developed using curbside drop off areas in front of the former terminal or through construction of a dedicated lot with the demolition of the building.

In summary, Alternative 18 offers the most advantageous site to expand rental car parking while including a location for a potential QTA facility. Alternative 20 is the most financially feasible option as compared with Alternative 19 and Alternative 21 for increasing public long-term parking and rental car storage. Finally, use of land within the area of the former terminal building as identified by Alternative 19 offers the most ideal option to increase employee parking while aligning this area closer to the new terminal building.

4.11 Summary

Alternatives presented in this Chapter provide feasible and logical development options for the Airport to meet existing and anticipated demand throughout the next 20 years. The analysis of each alternative by operational, economic, and environmental factors helps weigh merits and deficiencies to identify improvements that will adequately meet facility requirements. Based on this review, the recommended alternatives will allow the Airport to meet user needs throughout the planning period. A summary of these recommended alternatives is illustrated in **Figure 4-26**.

Figure 4-26
Summary of Recommended Alternatives



Source: Mead & Hunt, Inc.

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Chapter 5
Environmental Overview

5

Environmental Overview

An overview of the known environmental concerns that could impact the implementation of the preferred alternatives proposed by the findings of this Master Plan is presented in this Chapter. General assessments of the 23 required National Environmental Policy Act of 1969 (NEPA) categories are presented in the following sections and provide information on constraints that exist in the area and data that can be used in developing a NEPA compliant document. This review does not determine or delineate any detailed environmental concern, nor can it be used in place of a Categorical Exclusion (CatEx), Environmental Assessment (EA), or an Environmental Impact Statement (EIS) to fulfill NEPA requirements. Instead, this Chapter will focus on environmental constraints that should be taken into consideration during planning and design phases of the preferred alternatives.

The environmental impact determinations presented in this Chapter are based on information collected from several resources. Early coordination letters distributed to federal and State environmental agencies and local officials provided feedback on specific areas of concern, technical information about the Airport and surrounding area, and specific mitigation and permitting requirements that may be necessary to implement the preferred alternatives. Geographic Information System (GIS) databases such as Federal Emergency Management Agency (FEMA) flood maps and the Michigan Department of Natural Resources and Environment Wetland Viewer identified the locations of specific environmental concerns. Finally, the February 2010 EA completed for the new Air Traffic Control Tower (ATCT) and base building was referenced to collect information on noted environmental concerns found at the Airport.

As noted previously, the following sections of this Chapter are based on the 23 NEPA categories outlined in Federal Aviation Administration (FAA) Order 5050.4B, *Airport Environmental Handbook*:

- 5.1 Noise
- 5.2 Compatible Land Use
- 5.3 Social Impacts
- 5.4 Socioeconomic Impacts
- 5.5 Environmental Justice
- 5.6 Air Quality
- 5.7 Water Quality
- 5.8 Department of Transportation (DOT) Act, Section 4(f)
- 5.9 Historic and Archaeological Resources

5.1 Noise

FAA Order 1050.1E, *Policies and Procedures for Considering Environmental Impacts*, requires that a noise analysis be conducted when an airport experiences more than 90,000 annual piston-powered aircraft operations, more than 700 annual jet-powered aircraft operations, a runway is relocated, strengthened or expanded, or when a new airport is sited. This analysis evaluates the effects of aircraft noise using the Day Night Average Sound Level (DNL), or the loudest average sound level in decibels (dB) from an average 24-hour operational day. A 10 dB noise penalty is added to each aircraft operation that occurs between 10 p.m. and 7 a.m. local time to account for the heightened sensitivity of noise during nighttime hours. A noise contour map is then developed mapping out beyond each runway end the decibel levels of aircraft noise to represent the level of impact on surrounding land uses. Areas of impacted land inside the 65 DNL contour are considered incompatible by 14 Code of Federal Regulations (CFR) Part 150 and may require an airport to revise aircraft arrival and departure procedures, establish voluntary noise abatement procedures, or insulate affected structures.

For actions involving a major runway extension serving Airplane Design Groups (ADG) III through VI, a noise analysis to evaluate the level of impact is required prior to construction. Designated as an ADG III runway, the 1,000 foot extension proposed for Runway 17/35 would qualify as a major runway extension and would require a noise analysis to be conducted. Using the Integrated Noise Model (INM), an average-value model designed to estimate long-term effects using average annual input conditions, a determination of the level of impact can be made for areas that would be affected by an increase in aircraft noise.

No significant impacts as a result of increased aircraft noise are anticipated with the extension of Runway 17/35. Though existing noise contours would be shifted to the south, no significant impacts to residential or commercial land uses are anticipated as the area which would be affected the most (with a slight increase in aircraft noise) is primarily undeveloped industrial land south of Romence Road. A noise impact analysis will determine the areas of land, if any, that may be impacted by an increase in aircraft noise and whether solutions must be developed to mitigate any potential impacts.

The other preferred alternatives recommended in this Master Plan are also not anticipated to significantly increase the impact of aircraft noise in areas surrounding the Airport. Limited operations conducted on Runway 9/27 that would be shifted to Runway 17/35 and Runway 5/23 are not anticipated to increase the level of aircraft noise experienced in areas under the approach and departure paths of these runways. The closure of the runway would actually reduce or eliminate the impact of aircraft noise in some areas east and west of the Airport as operations would no longer continue in the arrival and departure paths for Runway 9/27. Development of a Localizer Performance with Vertical Guidance (LPV) approach to Runway 17 is also not anticipated to significantly increase aircraft noise in areas under the approach path to the runway. Though a slight increase in the number of operations conducted in instrument weather conditions may occur, a significant increase in the amount of exposure or decibel level of sound in areas north of the Airport is not anticipated at this time.

5.2 Compatible Land Use

Land use planning has two objectives: to protect aircraft, people and property on the ground and to improve the quality of life for those living and working around an airport. Land use planning associated with environmental issues generally focuses on the impacts of aircraft noise and wildlife attractants.

The impact of aircraft noise not only impacts those who live and work near an airport, it also affects the ability of an airport to plan for future development. Land use compatibility planning helps to minimize the impacts of aircraft noise to those in close proximity of an airport, identifies land for expansion and improvement projects, and attempts to mitigate potential height obstructions. Land use compatibility planning also focuses on the proximity of landfills, water treatment plants, wetlands, and other incompatible land uses that may attract wildlife. Identifying these areas helps airports reduce wildlife hazards for both existing operations and future development.

Airport sponsors are directed by the FAA to use their best efforts to promote compatible land uses and zoning measures to influence compatible development adjacent to airport property. It is preferred that airports own and control all affected land surrounding an airport to maintain compatible land use. The FAA, however, recognizes that not all airports have land use control authority and encourages airports to promote compatible land uses through other means, such as working with local authorities to persuade local jurisdictions to impose airport-compatible zoning near airports.

A mix of industrial, residential, and agricultural land use surrounding the Airport restricts land acquisition opportunities to control incompatible land use. Easements offer an alternative method for the Airport to control obstructions from penetrating runway approach surfaces without the need to purchase land from existing property owners. It is recommended that the Airport continue to enter into agreements with surrounding property owners to prevent obstructions from impacting aircraft operations. An additional easement may be necessary for the extension of Runway 17/35 to control land use inside the relocated Runway 35 Runway Protection Zone (RPZ) that would be located south of Romence Road. Early coordination with Pfizer indicates that no future development is planned that would impact land use inside the future RPZ.

Review of the preferred alternatives indicates that surrounding land uses are anticipated to be compatible with the developments proposed in this Master Plan. The closure of Runway 9/27 reduces restrictions for land uses and obstructions to the east and west of the Airport. It is encouraged that these areas continue to be protected from development that may be incompatible with operation of the Airport. The acquisition of land for future general aviation (GA) development also helps the Airport limit surrounding incompatible land uses as it prevents opportunities for growth and development that may be incompatible to Airport operations. No additional land use concerns are anticipated for the remaining preferred alternatives. Land use compatibility should be continually reviewed in the future to confirm compatible land uses have been maintained in proximity to the Airport.

5.3 Social Impacts

Social impacts are the result of development actions that may impact the health and safety of children and the vitality of local businesses and the surrounding community. An evaluation of impacts must be conducted to determine if proposed actions could cause the relocation of homes and businesses, divide or disrupt established communities, change surface transportation patterns, interfere with planned development, or noticeably change employment. Any impacts should fully balance the level of impact with the benefits of the proposed actions to determine the level of mitigation that will be necessary.

Review of the preferred alternatives indicates that no social impacts are anticipated. Though property acquisition or an easement may be necessary to extend Runway 17/35, no impacts will occur to residential communities, ground transportation patterns, or area businesses. Discussions with Pfizer have indicated that no future development is planned within the area that would be impacted by the runway extension and no adverse impacts to its manufacturing operations would be experienced. Also, Romence Road, an important east-west traffic artery, would not be impacted as relocation or closure of the roadway would not be necessary. Removal of obstructions penetrating runway approach and Airport imaginary surfaces will also not result in any significant social impacts to the surrounding community. Pruning or clearing of trees penetrating obstruction surfaces will not require the relocation or disruption of residential communities, nor impact the local exchange of commerce in the community. Therefore, no other social impacts are anticipated with implementation of the preferred alternatives.

5.4 Socioeconomic Impacts

Major airport developments can often cause induced or secondary socioeconomic impacts to surrounding communities, such as population movement and growth, public service demands and changes in businesses and local economic activity. For example, actions that require a land purchase could displace a number of residents outside a community. This in turn lowers the tax base of the community resulting in a decrease of municipal funds and a possible reduction in the number of educational and business opportunities in the community. In determining socioeconomic impacts, the proposed development is analyzed to see how it will affect the socioeconomic makeup of local communities. Determinations are then made of the extent of the impact and how proposed mitigation will reduce or eliminate socioeconomic effects. These impacts are normally not significant enough for an EA unless other categories, such as land use, social and noise also exhibit significant impacts.

Improvements to the Airport are not expected to create a significant change in population, public service, or economic activity in the area but are anticipated to have positive effects on the surrounding community through the development of additional employment opportunities, business growth, and economic activity. Therefore, no detrimental significant socioeconomic impacts are anticipated.

5.5 Environmental Justice

The purpose of Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations*, is to identify, address and avoid disproportionately high and adverse human or environmental effects on minority and low-income populations. Environmental Justice is defined as the right to a safe, healthy, productive, and sustainable environment for all where “environment” is considered in its totality to include the ecological, physical, social, political, aesthetic, and economic environments.

Minority populations are commonly defined as African American, Hispanic, Asian or Native American individuals. Each or all of these ethnic groups may live in geographic proximity to one another or may be geographically scattered. Generally, when defining a minority population in relation to project impacts, the minority population or populations must exceed 50 percent (50%) of the total population within the vicinity of expected impacts.

Low-income populations are defined as any group of persons identified as low-income, based on the most recent U.S. Census Bureau data, which live in geographic proximity to a proposed project. Several methods are used to calculate low-income population that take into account the Department of Health and Human Services poverty levels and the U.S. Census Bureau’s annual statistical poverty thresholds.

Based on the data provided in the EA for the new Airport air traffic control tower, and a review of the 2000 Census data, there are no disproportionate concentrations of minority, low-income or other people with special transportation needs in the project area. Consequently, as part of this Master Plan study, it was verified that disproportionately high adverse impacts to minority or low-income populations are unlikely. This element should be reviewed in the future to confirm that future projects do not adversely affect minority or low-income population groups within the vicinity of the Airport.

5.6 Air Quality

Air quality analyses are needed when a project, due to its size, scope, or location, has the potential to impact the attainment and maintenance of established National Ambient Air Quality Standards (NAAQS) for six criteria pollutants. Compliance with these standards means ambient outdoor levels of these pollutants are safe for human health, the public welfare and the environment. Compliance with State regulations may also be necessary in areas that have been designated as attainment, nonattainment, or maintenance for each of the criteria pollutants.

Typically, development actions occurring at airports having 180,000 annual GA and air taxi operations or more than 1.3 million enplanements are required to perform an air quality analysis. Forecasts developed for the Airport project enplanements and GA operations will be significantly less than these thresholds, therefore not requiring an air quality analysis to be performed for any of the preferred alternatives. Any increase in aircraft operations or vehicle traffic as a result of the preferred alternatives is not anticipated to reach levels that could significantly reduce air quality. As such, no long-term impacts to air quality are anticipated.

Emissions from vehicles and equipment during construction may temporarily reduce air quality, but are not anticipated to result in any long-term impacts. Any temporary increase in pollutants is not anticipated to be at levels that would pose significant short-term or long-term health risks to the Airport or the surrounding community. To help mitigate any potential temporary impacts, all emission control equipment on vehicles and construction apparatuses should be maintained to manufacturer standards to help limit the level of air pollutants discharged into the environment.

5.7 Water Quality

If not properly controlled, sediment from airport construction activities and fluids from aircraft fuels, lubricants, hydraulics, and anti-icing/de-icing chemicals have the potential to pollute above and below ground water sources. Activities that could impact navigable waterways, municipal drinking water supplies, important sole-source aquifers, or protected groundwater supplies must be evaluated to determine their impact on water quality. The Clean Water Floodplains and Floodways Act of 1977, also known as the Clean Water Act (CWA), and several other federal, State and local regulations provide guidelines and requirements for the discharge of waste and storm water to protect waterways and drinking water supplies. Permits, such as a National Pollution Discharge Elimination Systems (NPDES) permit, may be necessary from federal, State and local agencies to discharge storm and waste water.

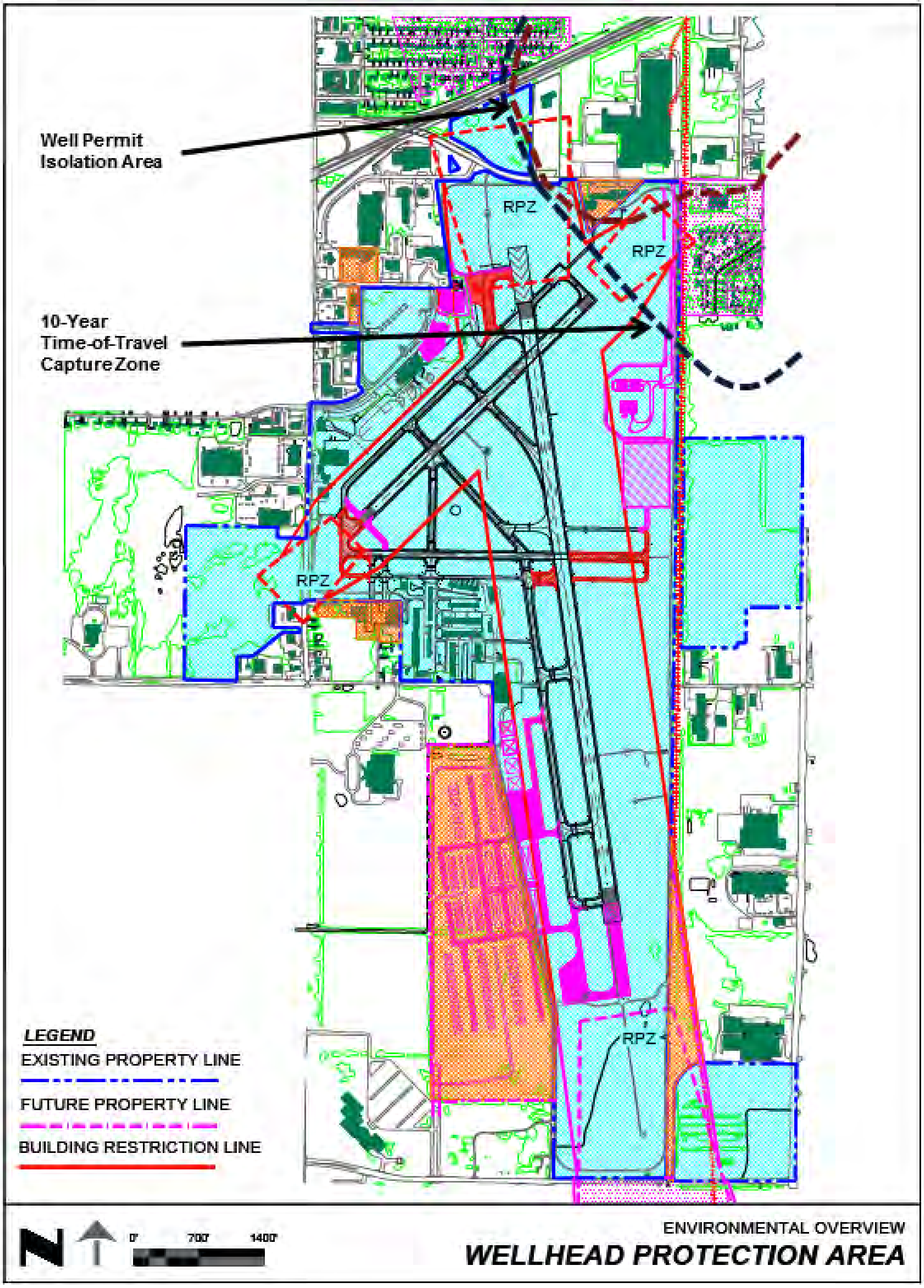
In an effort to preserve sources of drinking water, the City of Kalamazoo has designated Wellhead Protection Areas (WHPA) to prevent and protect surface and subsurface aquifers that supply water to wells and well fields. A Well Permit Isolation Area and 10-Year Time-of-Travel capture zone within a designated WHPA lies within Airport property to the north as illustrated in **Figure 5-1**. Though development is not planned within this area, best management practices should be used during construction to control sediment and waste water runoff from impacting above and below ground water quality in this area.

Improvements to the aircraft deicing area located southwest of the terminal area on the main ramp should also consider storm and waste water control measures to prevent or limit the impact of aircraft deicing fluids on water quality. Deicing fluid capture, recycling, and treatment controls should be incorporated into the design of storm and waste water drainage to prevent or limit the level of fluids (such as glycol) from entering area waterways. Additional water quality permits, certifications, and approvals from federal, State and local agencies may also be required to discharge waste water when deicing activities are being conducted.

The impact of storm and waste water runoff on the city of Portage's water supply should also be considered for activities and development planned in the future GA development area. Currently, property in this area is located in the city of Portage and is serviced by its water and sanitary sewer systems. If proper control and treatment mechanisms are not in place for activities that occur within this area, water supplies and sanitary sewers may become contaminated.

Construction within the GA development area should follow best management practices to limit sediment runoff from infiltrating Portage's water supply. Sewer and drainage controls should be designed so all waste and storm water is collected and processed at a water treatment facility. Additional water quality permits and assessments from federal, State and local agencies may also be required for development and activities occurring within this area to evaluate potential impacts on area water quality.

Figure 5-1
Wellhead Protection Area



Source: City of Kalamazoo Wellhead Protection Zoning Overlay
Illustration: Mead & Hunt, Inc.

5.8 Department of Transportation (DOT) Act, Section 4(f)

Section 4(f) of the Department of Transportation (DOT) Act provides that the Secretary of Transportation will not approve any program or project that requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, State or local significance. In additional, land from a historic site of national, State or local significance may not be used unless there are no other feasible and prudent alternatives.

To analyze the potential for Section 4(f) impacts, the Airport ATCT EA was reviewed and agency coordination was conducted to determine if impacts could be anticipated. As a result of this analysis, it was determined that land acquisition impacting a Section 4(f) property is not anticipated for any project included in this Master Plan. Therefore, no impacts to Section 4(f) property will occur.

5.9 Historic and Archaeological Resources

Section 106 of the National Historic Preservation Act (NHPA) requires Federal actions to consider potential impacts on historic properties. Any prehistoric or historic district, site, building, structure or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP) maintained by the Secretary of the Interior is included in Section 106 of the NHPA. Properties or sites having traditional religious or cultural importance to Native American Tribes and Hawaiian organizations may also qualify. Regulations require consultation with State Historic Preservation Officers (SHPOs) and Tribal Historic Preservation Offices (THPOs) to determine if a proposed development could impact a site of historic or cultural significance.

In the nineteenth century, the Airport location was the site of a four square mile Potawatomi village and tribal burial ground known as Indian Fields. Though the exact locations of the village and burial ground are not documented, artifacts may be uncovered during excavation or other earth work activity that takes place on Airport property. If any artifacts of historic or tribal importance are found, all work should be halted until a SHPO of the Bureau of Michigan History and appropriate THPOs are contacted to determine the historical significance of the site. Additional environmental clearance may be necessary to review the historical and cultural importance of the project site if artifacts of significance are found. No additional sites of historic, archaeological or cultural importance were identified on or adjacent to the Airport.

5.10 Biotic Resources

Biotic resources are various types of flora (plants) and fauna (fish, birds, reptiles, amphibians, marine mammals, coral reefs, etc.) in a particular area that includes rivers, lakes, wetlands, forests, upland communities and other habitats supporting flora and aquatic and avian fauna. Developments that could affect a stream or water body supporting biotic resources must consult with the U.S. Fish and Wildlife Service (USFWS) to assess potential impacts on aquatic areas.

Consultation with the Michigan Department of Environmental Quality (MDEQ) and the Michigan Department of Natural Resources (MDNR) may also be required.

A wetland area to the south that may support a biotic community would be impacted by the extension of Runway 17/35 and relocation of the railroad. Though this area is not capable of supporting fish, other aquatic species such as reptiles, amphibians, and plant life common to a wetland ecosystem may be present. Additional review of the flora and wildlife found in this area, as required in the development of a NEPA compliant document, can determine if the area supports a biotic community and can further evaluate the level of impact the proposed developments would have on this area.

5.11 Endangered and Threatened Species

The Endangered Species Act of 1973 (ESA), as amended, provides for the protection of certain plants and animals, as well as the habitats in which they are found. Species of special concern are not formally afforded regulatory protection; however, any reduction in their number or habitat is of concern from a State, regional and/or national perspective. In compliance with the ESA, agencies overseeing federally-funded projects are required to obtain from the USFWS information concerning any species listed, or proposed to be listed, which may be present in the area of the proposed project. Since the State of Michigan is a recipient of federal funds, as well as an agency overseeing the federally-funded project, coordination with the MDNR is required.

In determining the impact of future development, a review will be conducted of federal and State lists of endangered or threatened species. If it is determined that none of these species or habitats are found in the area of the proposed development, a prepared environmental document will state this and planning for construction may begin. If it is determined that the proposed development may affect an endangered or threatened species or habitat, the USFWS or the National Marine Fisheries Service (NMFS) will be contacted and notified of the proposed development and provided a list of species or habitats thought to be impacted.

Threatened and endangered species are not anticipated to be impacted by implementation of the preferred alternatives. Coordination with the United States Department of Agriculture (USDA) Wildlife Services, the MDEQ, the MDNR and the USFWS, as part of the Master Plan process, noted that any future development would not significantly impact any endangered or threatened species. However, as federal and State protected species lists change, it will be important that an updated assessment of species and habitats on or in the vicinity of the Airport be conducted before any future development occurs.

5.12 Wetlands

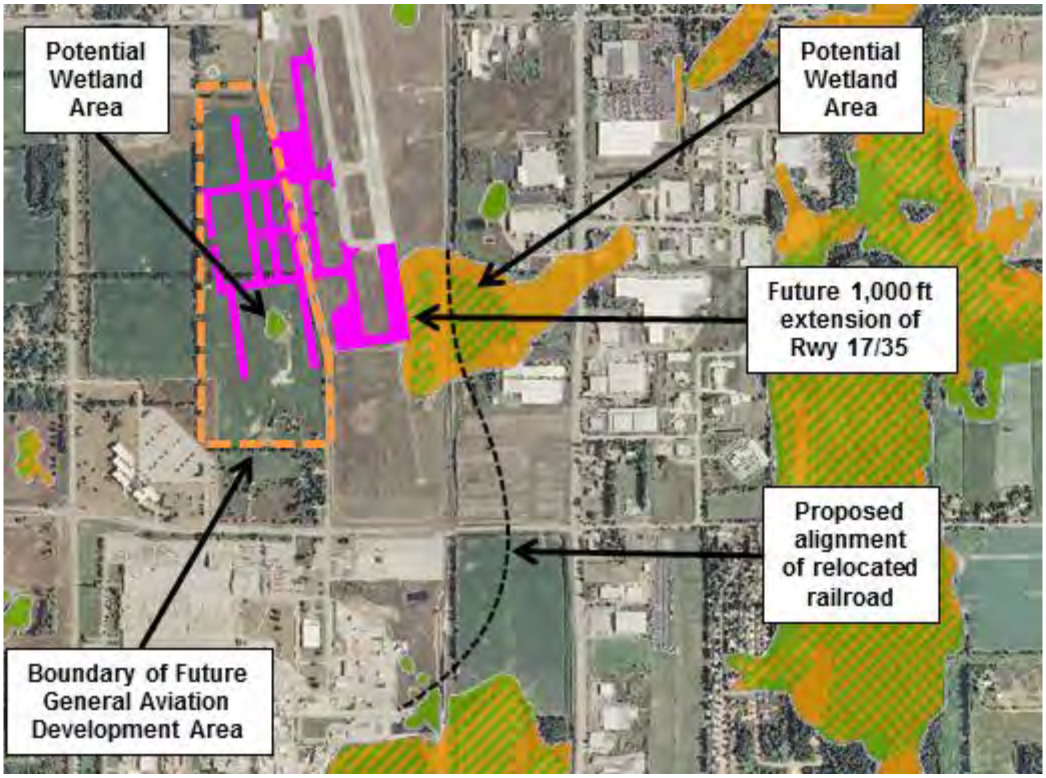
U.S. DOT Order 5660.1A, *Preservation of the Nation's Wetlands*, defines wetlands as lowlands covered with shallow and sometimes temporary or intermittent waters. This includes swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, tidal overflows, estuarine areas, and shallow lakes and ponds with emergent vegetation. Evaluation by a qualified delineation specialist reviewing site characteristics is needed to determine if an area is a wetland. Development is to be avoided in wetlands if practicable alternatives exist. If wetlands are to be disturbed, permits and credits from federal and State agencies may be required in addition to the creation of wetlands off Airport property to achieve a no net loss ratio in accordance with Executive Order 11990.

The MDEQ, in pursuant to Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act of 1994, drafted wetland inventory maps designed to show the potential and approximate locations of areas supporting wetland conditions. Though an on-site evaluation is required to delineate wetland boundaries, these maps identify areas that support the wetland area characteristics. As illustrated in **Figure 5-2**, wetlands may be present to the south of Runway 17/35 and within the area identified for future GA development. Proposed extension of the runway, relocation of the railroad, and development occurring within the future GA area may impact these potential wetland areas. Additional field verification by a qualified specialist will be required to determine if wetlands are present as required during the NEPA environmental process. A permit under Part 303 of the Natural Resources and Environmental Protection Act of 1994 may be required for fill material depositing, dredging, soil removal, or surface water drainage to occur in these areas if it is designated as a wetland. Further analysis conducted as part of the NEPA process can determine if additional mitigation measures are needed to reduce any adverse impacts that could occur to these potential wetland areas.

5.13 Floodplains

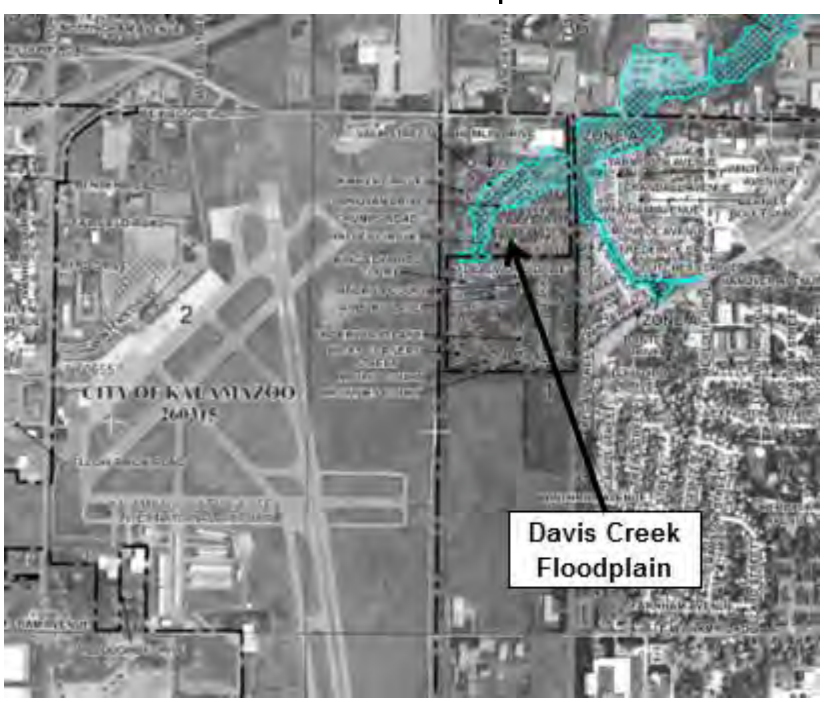
Executive Order 11988, *Floodplains*, and U.S. DOT Order 5650.2, *Floodplain Management and Protection*, state all airport development actions must avoid floodplains if practicable alternatives exist. If no practicable alternatives exist, actions within a floodplain must be designed to minimize adverse environmental impacts and minimize potential risks for flood-related property loss and impacts on human safety, health, and welfare. Typically, airport development is discouraged within a 100-year floodplain, or area of inundation that has a frequency of occurring, on average, once every 100 years. Flood insurance rate maps developed by FEMA indicate that no floodplains are present on Airport property; therefore impacts to floodplains are not anticipated. It should be noted that the Davis Creek floodplain lies adjacent to the Airport as illustrated in **Figure 5-3**. Though development is not planned within this area, care should be taken to avoid any indirect impacts that could affect the natural and beneficial values of the floodplain.

Figure 5-2
Potential Wetland Area



Source: Michigan Department of Natural Resources and Environmental Wetland Viewer

Figure 5-3
Davis Creek Floodplain



Source: Flood Insurance Rate Map, Federal Emergency Management Agency

5.14 Coastal Barriers and Coastal Zone Management

Coastal zones are defined as islands, beaches, transitional and intertidal areas, and salt marshes that are located along the coastlines of the Atlantic Ocean, Pacific Ocean, Gulf of Mexico and the Great Lakes. The *Coastal Zone Management Act of 1972* established the Federal Coastal Zone Management Program to encourage and assist states in preparing and implementing management programs to *"preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone."*

The Airport is located inland and not in proximity of a coastal zone management area; therefore, implementation of the preferred alternatives will not impact coastal resources.

5.15 Wild and Scenic Rivers

Wild and scenic rivers are those waterways that are designated as having a remarkable scenic, recreational, geological, fish, wildlife, historic or cultural values. The National Wild and Scenic Rivers System (NWSRS), maintained by the Secretary of the Interior, identifies rivers that are offered protection from the *Wild and Scenic Rivers Act of 1968.* Review of the NWSRS database and coordination with the MDNR indicated that no wild and scenic rivers are in proximity of the Airport; therefore, no impacts are anticipated.

5.16 Farmlands

Land having ideal soil composition to support agriculture is protected by the Farmland Protection Policy Act (FPPA) of 1981 from unnecessary and irreversible conversion to non-agricultural uses. Farmland, pastureland, cropland, and forests can be considered "prime", "unique" or "statewide and locally important" if it meets certain soil composition characteristics. Land designated as "prime" farmland has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimal use of fuel, fertilizer, pesticides, or products. "Unique" farmland has a special combination of soil quality, location, growing season, and moisture necessary to produce high-value food and fiber crops or high yields of them economically. Land determined by State or local officials to be of agricultural importance can be designated as "statewide and locally important" if approved by the USDA Natural Resource Conservation Service (NRCS) or a designated representative such as a State Conservationist.

The NRCS Web Soil Survey database classifies land designated for future GA development at the Airport as "prime" farmland. Submission of a USDA Farmland Conversion Impact Rating Form AD-1006 is recommended to further evaluate whether the land still rates as "prime" and whether alternate measures, such as reducing the acreage of impacted land or using land with a lower relative value, should be considered. Additional coordination with the NRCS is encouraged as a part of the NEPA environmental review process prior to construction.

No additional farmland impacts are anticipated as remaining development is planned to occur on soils not designated as significantly important for agricultural purposes.

5.17 Energy Supply and Natural Resources

Any airport development project subject to FAA approval or receiving funding from the Airport Improvement Program (AIP) must be evaluated to determine potential impacts to energy supplies and natural resources. Regulations set forth by the Council on Environmental Quality (CEQ) require an assessment of a proposed action's energy requirements, efforts to conserve energy, and impacts on natural or consumable resources. Though airport improvement projects may have the potential to increase energy requirements and natural resource consumption, it is typically not to a point that would significantly cause demand to exceed supply. In an effort to reduce or limit any potential impacts, the FAA encourages airports to incorporate environmental sustainability into any airfield or landside development project.

Extending Runway 17/35 and Taxiway B will require additional runway and taxiway edge lights, potentially increasing energy consumption for airfield lighting. Installation of energy-efficient Light Emitting Diode (LED) runway and taxiway lights, where applicable, can help greatly reduce the level of additional energy supply that may be needed. Additional conversion of traditional incandescent airfield lighting to LED fixtures may help reduce the level of energy needed for airfield lighting, resulting in cost savings for the Airport. Any increase in energy usage that may occur as a result of additional airfield lighting is not anticipated to significantly impact local supplies or increase strain on local and regional power grids.

Construction of a consolidated Aircraft Rescue and Fire Fighting (ARFF)/Snow Removal Equipment (SRE) building, a rental car quick turn-around (QTA) facility and new GA hangars and facilities have the potential to increase energy consumption at the Airport; however, use of environmentally sustainable building design and construction techniques can greatly reduce the level of any potential adverse impacts. Guidelines set forth by the Leadership in Energy and Environmental Design (LEED) rating system, Green Globes and Energy Star provide a framework for environmental sustainable practices that can be used in building construction techniques. Incorporation of other design elements such as automated building controls, geothermal heating and cooling, occupancy/daylight light sensors and low flow water fixtures can be included to reduce the level of energy needed for these new facilities. Energy and cost savings may even be realized for the Airport with construction of environmentally sustainable buildings to replace those that are energy-inefficient. As a result, no significant impacts to energy supplies are anticipated with construction of additional buildings.

Reuse of existing airfield construction materials can also help reduce or prevent any potential impact to natural resources. Recycling of raw materials such as removed concrete and asphalt for use as a sub-base or in the creation of new pavement itself are examples of construction practices that can limit the necessity for natural raw material resources. Reuse of existing pavements, such as a closed runway for a taxiway demonstrated by the closure of Runway 9/27, also is an environmentally friendly practice that reduces the necessity for natural resources. Through the use of such practices, consumption of raw materials for the development of additional airfield infrastructure is not anticipated to significantly impact natural resources.

5.18 Light Emissions and Visual Effects

Aviation lighting required for security, obstruction clearance, and navigation are chief contributors to light emissions radiating from airports. An analysis is necessary when projects include the introduction of new or relocated airport lighting facilities that may affect residential or other sensitive areas. For example, high-intensity strobe lights may shine directly into residences, or overhead apron, parking, or streetlights may create glares that affect pilots and air traffic controllers. Only in these types of unusual circumstances should the impact of light emissions be considered sufficient to warrant a special study for a more detailed examination of alternatives.

The location and orientation of existing and potential future lighting systems are not expected to adversely affect local residences or other areas in proximity of the Airport; therefore, no significant impact is anticipated. Additional analysis may be needed if it is determined through the environmental review process that lighting from the preferred alternatives could create adverse light emissions and visual effects.

5.19 Solid Waste

Most airport construction, renovation or demolition projects produce different types of waste that must be properly disposed. Debris from airfield development projects such as dirt, concrete, asphalt, and materials from building construction or demolition such as bricks, steel, wood, and glass each can increase the volume of waste generated from an airport, impacting processing and disposal facilities. In addition, the volume of waste generated at an Airport from daily operational activities such as passenger terminal operations, air cargo processing facilities, parking facilities, and rental car operations has the potential to impact waste processing and disposal facilities. To minimize any potential environmental impacts, NEPA environmental documents should review the temporary and long-term effects of solid waste generated as a result of airport development projects.

The Solid Waste Disposal Act defines solid waste as garbage, refuse, or sludge from water treatment and includes solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, agricultural, or community activities. Review of the preferred alternatives indicates that temporary increases in waste volumes may be experienced during construction as a result of material packaging and non-reusable waste from building demolition and airfield surface removal. Any temporary increase in the volume of solid waste generated is not anticipated to significantly impact facilities that process and depose of waste. Refuse generated from daily operations of the proposed developments, in consideration with existing waste streams and project increases in Airport activity, are also not anticipated to adversely impact the disposal of solid waste. All temporary and permanent waste removal should be conducted in accordance with federal, State and local regulations.

In addition to evaluating the generation of solid waste, the proximity of landfills and their potential impacts to airport operations are also analyzed as part of the environmental review process. Landfills are considered both an incompatible land use and a wildlife attractant concern for airports. To address these concerns, FAA Advisory Circular (AC) 150/5200-33B, *Hazardous Wildlife Attractants on or near Airports*, requires a minimum separation of 5,000 feet between landfills and airports serving piston-powered aircraft and 10,000 feet between landfills and airports serving turbine-powered aircraft.

MDEQ records indicate the nearest active landfill to the Airport is the Kalamazoo Valley Group landfill, a Type III landfill that can accept low hazardous waste located approximately nine miles to the east near Galesburg. The location of this landfill exceeds the required separation distance identified in AC 150/5200-33B, therefore does not significantly attract wildlife that could pose a threat to Airport operations.

5.20 Construction Impacts

Airport construction projects have the potential to cause various environmental effects primarily due to dust, heavy equipment emissions, storm water runoff containing sediment, spilled and/or leaking petroleum products, and noise. Though temporary, construction impacts should be evaluated as part of the environmental review process to determine general types and natures of construction related impacts and the measures proposed to minimize potential adverse effects. Standards specified in FAA AC 150/5370-2E, *Operational Safety on Airports During Construction,* provide safety guidelines and best management practices that should be followed for all construction activities occurring at an airport. Additional federal, State and local ordinances and regulations may also govern construction procedure and operations to reduce any potential environmental impacts.

No significant short-term environmental impacts are anticipated during construction of the preferred alternatives. Any potential soil erosion or sediment runoff that may occur should be controlled by appropriate erosion prevention devices such as sediment basins and silt fences along with soil erosion and sedimentation control permits from federal, State, or local agencies to minimize any potential adverse effects. Storm water discharges associated with construction activities may require a Stormwater Pollution Prevention Plan (SWPPP) and a NPDES permit to effectively prevent storm and waste water runoff from polluting area waterways. Emissions from heavy equipment and vehicles may temporary reduce air quality during construction, but not at levels that could cause significant respiratory health issues for the surrounding community.

Temporary increases in solid waste generated from debris, building demolition, pavement surface removal, and packaging materials are not anticipated to strain the capacity of local disposal facilities.

It should also be noted that construction of the preferred alternatives may result in beneficial economic impacts to the local community. The use of local contractors and suppliers during construction may help create additional construction-related employment opportunities for the area workforce. Additional full-time employment as a direct or indirect result of the proposed developments will not only benefit the exchange of commerce at the Airport, but also help to support economic activity throughout Kalamazoo and the Southwest Michigan region.

5.21 Hazardous Materials

Federal, State, and local laws regulate the use, storage, transport, and disposal of hazardous materials, defined as those substances associated with industrial wastes, petroleum products, dangerous goods, or other contaminates. Other solid, liquid, or gaseous wastes that are ignitable, corrosive, reactive, or toxic also must require care in storage, transit, and disposal under the governance of several environmental regulations. The environmental review process includes an evaluation of potential hazardous material sites, facilities, or properties located both on and off Airport property that could impact the implementation of a proposed alternative.

Review of the MDEQ databases indicates two off-airport hazardous material sites regulated by Part 201 of the Michigan Natural Resources and Environmental Protection Act (NREPA) could impact the relocation of the railroad as part of the Runway 17/35 extension project. Two former manufacturing and metal finishing sites, located east of the Airport at 3700 and 3900 Milham Road as indicated in **Figure 5-4**, are contaminated with various metals used in the metal finishing, polishing, and buffing applications. Though this site is adjacent to the Airport, it is located approximately 2,000 feet north of the proposed realignment of the railroad and should not be impacted by any other planned development. However, this site should be noted for the relocation of the railroad should design standards or an unforeseen circumstance require the track tie-in point to be north of its proposed location.

5.22 Cumulative Impacts

Cumulative impacts are those that a proposed action would have on a particular resource when added with past, present, and reasonably foreseeable actions within a defined period of time and geographical area. An example would be the cumulative impacts on a wetland area over a period of several years resulting from multiple projects. The environmental review process requires qualitative and quantitative analyses of past activities along with the consultation with various agencies, tribes, and developers to determine if cumulative impacts have occurred to any of the twenty-three (23) environmental categories presented in this Chapter.

Figure 5-4
Part 201 Hazardous Site Locations

Source: Michigan Department of Environmental Quality Environmental Mapper

No foreseeable cumulative impacts are anticipated to any of the environmental categories presented in this Chapter as a result of the preferred alternatives. Development planned for sites that have been previously disturbed by existing Airport infrastructure such as the construction of the rental car QTA facility, closure of Runway 9/27 and the creation of additional long-term vehicle parking will not result in any additional environmental impacts. Disturbances of sites not previously affected by Airport development such as the extension of Runway 17/35, construction of a consolidated ARFF/SRE building, and development of additional GA areas will result in limited environmental impacts that are not cumulative in nature. Review of past, existing, and planned future development conducted during the environmental review process can further evaluate the potential of cumulative impacts that may result with implementation of the preferred alternatives.

5.23 Anticipated Environmental Documents

Most of the preferred alternatives, either individually or cumulatively with other proposed actions, are not anticipated to result in any significant environmental impacts. Therefore, preparation of a CatEx is anticipated to satisfy the environmental review process and NEPA documentation requirements as defined in 40 Code of Federal Regulations (CFR) 1508, *Protection of Environment* for most projects proposed in this Master Plan. Categorical exclusions are typically prepared for actions that do not induce significant impacts to planned growth or land use; natural, cultural, recreational, or historic resources; travel patterns; air, noise or water quality; do not require the relocation of substantial numbers of people; and, based on previous experiences with similar projects, do not significantly impact the environment. Any unforeseen circumstances such as significant environmental impacts, substantial public controversy, significant impacts to Section 4 (f) or Section 106 historic properties, or inconsistencies with federal, State or local regulations that are encountered during the preparation of a CatEx may require a more extensive review. If any of these circumstances are experienced, an EA should be considered to satisfy the NEPA environmental review process and meet documentation requirements.

The extension of Runway 17/35 is a major development action that requires a concise environmental evaluation offered by an EA to determine the significance of any potential impacts. EAs are typically prepared when the significance of potential impacts is unknown to help determine whether an environmental impact statement is needed or if the proposed action results in no significant impacts. Initial review of potential environmental concerns indicates that impacts may be possible to a wetland area and its associated biotic community with the extension of Runway 17/35. Preparation of an EA prior to construction can further determine the level of impact on the 23 environmental categories presented in this Chapter. If it is determined that extension of the runway will not significantly impact the environment, a Finding of No Significant Impact (FONSI) will be prepared to document the decision. If significant impacts are to be anticipated, an EIS will be required to disclose the process in which the project was developed, including the consideration of a full range of alternatives, reasoning why some alternatives were eliminated from consideration and justification why the preferred alternative is the logical course of action. An EIS is not anticipated for any of the preferred alternatives presented in this document.

5.24 Summary of Anticipated Impacts

As mentioned, the environmental overview provided in this Chapter is not intended to meet or satisfy requirements addressed by the National Environmental Policy Act of 1969 or FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions.* Development of a NEPA compliant document such as a CatEx, EA, or an EIS is required for each proposed action to further evaluate the level of environmental impact and determine if mitigation measures or selection of another alternative is necessary to reduce adverse effects. Instead, the purpose of this environmental overview is to provide data and information that can be used in preparing a NEPA compliant document for future Airport projects.

The summary below provides a recap of the environmental concerns that may arise with the implementation of the preferred alternatives. Though several environmental concerns were identified, potential impacts are anticipated to be minimal and can be easily mitigated. The following environmental concerns include:

- **Noise –** An increase in the intensity and duration of aircraft noise resulting from the preferred alternatives is not anticipated; however, a noise analysis will be required for the proposed extension of Runway 17/35 as directed by FAA Order 1050.1E, *Policies and Procedures for Considering Environmental Impacts*.

- **Water Quality –** A Wellhead Protection Area designated by the City of Kalamazoo lies within the northern boundary of Airport property. Though development is not planned for this area, waste water and storm water controls may be necessary to prevent pollution and sediment runoff from infiltrating this protected area. Water quality permits, certifications, and approvals from federal, State, and local agencies may also be required to discharge waste water, especially from aircraft and runway anti-icing/de-icing activities.

- **Historic and Archaeological Resources –** The Airport location was the site of a Potawatomi village and tribal burial ground known as Indian Fields in the nineteenth century. Though the exact locations of the village and burial ground are unknown, artifacts could be uncovered during excavation or earthwork that occurs both on and in proximity of the Airport.

- **Biotic Resources –** Extension of Runway 17/35 and relocation of the railroad may impact a wetland area that could support life common to a biotic ecosystem. Further evaluation should be conducted prior to construction to determine if any biotic resources in this area could be impacted.

- **Wetlands –** MDEQ maps indicate potential wetland areas may be impacted with the extension of Runway 17/35, relocation of the railroad, and development occurring within the future GA area. Analysis conducted as part of the NEPA environmental review process can further review the characteristics of these areas to determine if they qualify as wetlands. Wetland permits and credits may also be necessary before any construction or development occurs.

- **Floodplains –** Review of FEMA flood insurance rate maps indicate no floodplains are present on Airport property. Diligence should be maintained however, to avoid any indirect adverse impacts to the Davis Creek floodplain located to the northeast, adjacent to Airport property.

- **Farmland –** Soils identified by the NRCS on land indicated for future GA development is rated as “prime”, or having the best combination of physical and chemical characteristics to produce agricultural crops. Submission of a farmland conversion impact rating form is recommended to further evaluate the composition of this soil and its potential impacts with its conversion to non-agricultural use.

- **Energy Supply and Natural Resources –** Incorporating environmentally friendly building design and the use of energy efficient LED airfield lighting can help mitigate any potential increases in energy demand that may occur with implementation of the preferred alternatives. Use of other sustainable design elements such as automated building controls, geothermal heating and cooling, occupancy/daylight light sensors, and low flow water fixtures can also contribute to reduced energy supply and natural resource impacts. Reuse of existing pavement infrastructure such as removed concrete and asphalt for use as a sub-base or in the creation of new pavement also are sustainable construction techniques that can reduce any impact to natural resources.

- **Solid Waste –** Removal of debris, refuse, and raw materials from construction or demolition processes may temporary increase in the volume of solid waste generated at the Airport. Any temporary increase is not anticipated to significantly impact disposal facilities or strain waste collection methods. Long-term solid waste impacts from the daily operations of the preferred alternatives are also not anticipated to significantly impact the Airport's solid waste stream.

- **Construction Impacts –** Construction activities are not anticipated to significantly create any short-term adverse environmental effects. Any potential impacts such as noise, air pollution, and generation of solid waste are anticipated to be minimal and not significantly impact area resources or the surrounding community. Temporary measures such as sedimentation controls to prevent soil erosion and development of a SWPPP may be necessary to prevent or limit the discharge of waste and storm water from construction sites into area streams, drinking water supplies and waterways.

- **Hazardous Materials –** Two contaminated sites regulated by Part 201 of the MNREPA are adjacent to the Airport approximately 2,000 feet north of the proposed railroad relocation. Though these sites are not anticipated to impact the extension of Runway 17/35 or the relocation of the railroad, they should be noted if railroad design standards or unforeseen circumstance require the track tie-in point to be north of its existing proposed location.

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Chapter 6
Capital Improvement Plan

6

Capital Improvement Plan

Implementation of the recommended alternatives is guided by a Capital Improvement Plan (CIP) that establishes a timeline and cost estimate for each planned improvement. CIPs help identify the level of financial, staffing, and scheduling resources needed for each improvement while organizing the timing of necessary preliminary projects such as design plans, land acquisitions, and environmental reviews. CIPs also help illustrate the capital needs of an airport, assisting the funding allocation decisions of federal, state, and local officials.

The CIP prepared for the Kalamazoo/Battle Creek International Airport outlining projects identified in this Master Plan, as well as those listed on the Fiscal Year 2013-2023 Airport Capital Improvement Plan (ACIP) has been submitted to the Michigan Department of Transportation Office of Aeronautics (MDOT Aero), and is presented in this Chapter in the following sections:

6.1 Capital Improvement Plans
6.2 Estimated Costs for Future Development
6.3 Funding Resources
6.4 Summary

6.1 Capital Improvement Plans

CIPs summarize the short-, medium-, and long-term development plans of an airport, outlining infrastructure improvement projects such as runway and taxiway extensions, operational needs such as pavement rehabilitations, and equipment purchases such as Aircraft Rescue and Fire Fighting (ARFF) and snow removal equipment (SRE) vehicles. CIPs include the capital needs associated with each proposed project and are updated periodically based on changing conditions and priorities. CIPs must also be coordinated with projects identified in master plans and Airport Layout Plans (ALPs) and include projects both eligible and ineligible to receive federal funding. Projects eligible to receive federal funding from the Airport Improvement Program (AIP) must be identified on an airport's CIP as this source of information updates the Federal Aviation Administration (FAA) database used in awarding funds. In addition to projecting the level of financial resources needed for each proposed project, CIPs also help balance scheduling conflicts, identify timelines for environmental review requirements, and address property needs such as leases, easements, and land acquisitions.

6.2 Estimated Costs for Future Development

As summarized in **Table 6-1**, approximately $60.2 million in improvement projects, equipment purchases, and planning initiatives are listed on the Airport's CIP. A breakdown of the funding share for each project is also included with those meeting eligibility requirements receiving ninety-five percent (95%) of funds from federal sources, 2.5 percent (2.5%) from State of Michigan sources, and 2.5 percent (2.5%) from local sources. Projects are listed chronologically based upon priority and grouped by short-term (2013-2015), mid-term (2016-2020), and long-term (2021-2025) needs.

Significant investment ($22.4 million) is planned during the short-term to address Airport needs through 2015. Landside improvements planned during this time period include demolition of the former terminal, construction of a consolidated ARFF/SRE building, and construction of a rental car quick turnaround (QTA) service facility. Airside improvements planned during this same time period include pavement crack sealing, rehabilitation of Taxiway C, and installation of runway guard lights for intersecting taxiways.

In 2016, conversion of Runway 9/27 into a taxiway/reorientation of the taxiway intersections at the approach end of Runway 5 is planned as well as removal of the closed northern section of Taxiway B. After a benefit/cost analysis and an environmental assessment are completed in 2016, work can proceed on scheduled design and construction of Runway 17/35 extension in 2018 and 2019, respectively. The combined $15.6 million in investment needed for this project during the medium-term planning period will limit available funds for other infrastructure improvements, though modifications to the de-icing area is scheduled to occur after the runway extension is complete in 2020.

Long-term projects planned after 2020 are more subject to changing priorities and could see the time frame of their implementation adjusted based on varying factors. Land acquisition for the expansion of the long-term parking lot could occur sooner than 2025 if demand for public parking increases at a rate greater than the level projected. It should be noted that acquisition of the properties that conduct through the fence operations in 2020 is only listed for planning purposes to demonstrate the anticipated level of financial resources needed for their purchase and to identify their eligibility for the use of federal funds. It is the longer term intent of the Airport to purchase these properties once they become available in the open market and not relocate existing landowners in 2025 if they are still present.

Table 6-1
Capital Improvement Plan Summary

Year	Project	Funding			
		Federal	State	Local	TOTAL
2013	Runway guard lights (RSAT project)	$502,200	$27,900	$27,900	$558,000
2013	Construction administration - runway guard lights	$55,800	$3,100	$3,100	$62,000
2013	Design for ARFF/SRE building	$1,017,000	$56,500	$56,500	$1,130,000
2013	Crack sealing and pavement marking	$90,000	$5,000	$5,000	$100,000
2013	Reimbursement for land purchase	$1,197,000	$70,000	$63,000	$1,330,000
2014	ARFF/SRE building	$10,602,000	$589,000	$1,209,000	$12,400,000
2014	Demolition of former terminal for employee parking	$0	$0	$600,000	$600,000
2015	Rehabilitate Taxiway C	$3,240,000	$90,000	$270,000	$3,600,000
2015	Rental car QTA building & ready/return parking lot	$0	$0	$2,650,000	$2,650,000
	Total for 2013-2015	**$16,704,000**	**$841,500**	**$4,884,500**	**$22,430,000**
2016	New ARFF vehicle	$720,000	$40,000	$40,000	$800,000
2016	Convert Runway 9/27 into taxiway	$450,000	$25,000	$25,000	$500,000
2016	Closed Taxiway B (north) removal	$323,000	$8,500	$8,500	$340,000
2016	Benefit/cost analysis for Runway 17/35 extension	$90,000	$5,000	$5,000	$100,000
2016	Environmental assessment for Runway 17/35 extension	$180,000	$10,000	$10,000	$200,000
2016	Preliminary engineering to support environmental assessment	$67,500	$3,750	$3,750	$75,000
2017	Land acquisition for Runway 17/35 extension	$4,050,000	$225,000	$225,000	$4,500,000
2017	Avigation easement and obstruction clearning	$380,000	$10,000	$10,000	$400,000
2017	Reimburseable agreement for relocating FAA owned NAVAIDS	$315,000	$17,500	$17,500	$350,000
2018	Relocate railroad for Runway 17/35 extension	$990,000	$55,000	$55,000	$1,100,000
2018	Design engineering for Runway 17/35 extension	$531,000	$29,500	$29,500	$590,000
2019	Construction Runway 17/35 extension	$7,470,000	$415,000	$415,000	$8,300,000
2020	Modifications to de-icing area	$450,000	$25,000	$25,000	$500,000
2020	Acquire land of through the fence operators	$1,800,000	$100,000	$100,000	$2,000,000
	Total for 2016-2020	**$17,816,500**	**$969,250**	**$969,250**	**$19,755,000**
2021	Rehabilitate Taxiway A	$2,385,000	$132,500	$132,500	$2,650,000
2022	SRE equipment replacement-plow	$630,000	$35,000	$35,000	$700,000
2022	SRE equipment replacement	$1,080,000	$60,000	$60,000	$1,200,000
2023	Rehabilitate Runway 5/23	$4,182,300	$232,350	$232,350	$4,647,000
2025	Land acquisition for long-term parking lot expansion	$8,355,250	$219,875	$219,875	$8,795,000
	Total for 2021-2025	**$16,632,550**	**$679,725**	**$679,725**	**$17,992,000**
	Total for 2013-2025	**$51,153,050**	**$2,490,475**	**$6,533,475**	**$60,177,000**

Note: This CIP is subject to revision and is to be updated periodically by the Airport
Source: Mead & Hunt, Inc.
Prepared: February 2013

6.3 Funding Resources

Several funding resources are available to accommodate the capital demands of the Airport to implement projects listed in their CIP plan. These funding sources range from federal and state programs to local mechanisms based on Airport revenue and number of transactions conducted by tenants. The following section reviews these resources and identifies projects included in the CIP plan that are eligible to receive funding from each.

6.3.a Airport Improvement Program – The Airport Improvement Program (AIP) was created by the Airport and Airway Improvement Act of 1982 and is administered by the FAA. Federal funding set aside for this program is distributed for eligible non-revenue producing projects at an airport, including planning, airfield construction and navigational equipment, Navigational aids (NAVAIDs), and environmental mitigation. AIP funds are distributed to different categories of public-use airports owned by public entities that are included in the National Plan of Integrated Airport Systems (NPIAS), with some exceptions made for public use airports under private ownership identified in the NPIAS.

Airports supporting commercial airline service are classified as Primary (10,000+ enplanements) or Non-Primary (2,500 – 10,000 enplanements) based on the number of annual enplanements. Primary commercial service airports are further classified based on the percentage of annual passenger enplanements in comparison with all passenger enplanements that occur annually at airports in the U.S. Since the Airport boards more than 10,000 passengers annually but accounts for less than 0.05 percent (0.05%) of all annual enplanements in the United States it is categorized as a non-hub primary airport. Both entitlement and discretionary AIP funds are available to Primary non-hub airports with entitlement amounts awarded based on the level of annual enplanements and discretionary amounts awarded on a project by project basis.

Utilization of this funding source can be applied to most of the projects identified on the CIP plan, most notably those that require a significant amount of capital such as the extension of Runway 17/35, conversion of Runway 9/27 into a taxiway, and construction of a consolidated ARFF/SRE building. Longer-term capital needs requiring a significant amount of funds will also benefit from this program such as the purchase of land for the expansion of the long-term parking lot, development of additional general aviation areas, and acquisition of properties conducting through the fence operations.

6.3.b State of Michigan Funding Assistance – The State of Michigan also sets aside funds collected from aviation fuel taxes and user fees to help airports finance infrastructure improvement projects. A portion of these funds is dedicated to assist airports in meeting the five percent (5%) local match required for projects receiving federal funding, generally requiring 2.5 percent (2.5%) of eligible costs be financed by the Airport while the remainder is paid for with State funds. The remaining State funds which are set aside for airport improvement projects are split between five programs for specific types of airports or for specific purposes.

In addition to utilizing State funding to meet the required local share, funds available from three State programs could also help finance pavement preservation and airfield safety projects identified on the CIP. The Crack Sealing and Paint Marking Program provides up to 50 percent (50%) of a project's eligible cost for the crack sealing and paint marking of runways. Funds available from this program could be utilized for pavement crack sealing planned in 2011 and 2012 along with pavement marking scheduled for 2011. The Safety and Security Program provides funds for safety and security projects that could be used to help finance the taxiway realignment at the approach end of Runway 5 and the installation of runway guard lights at taxiway/runway intersections. The third program, the Airport Loan Program, offers publicly owned airports the opportunity to borrow up to $100,000 for capital improvements. Funds available from this loan program could be applied to most projects listed on the CIP to help meet any funding gaps not covered by other federal, State, and local resources.

6.3.c Passenger Facility Charges – Passenger Facility Charges (PFCs) allow an airport to collect a fee from each enplaned passenger to help fund projects that preserve or enhance safety, security, and capacity, reduce the impacts of aircraft noise, or provide enhanced competition between air carriers. This funding mechanism helps an airport raise local funds for improvement projects that can be used in conjunction with other federal and state resources. Currently, federal regulations allow an airport to collect a PFC fee up to $4.50 per enplaned passenger.

Fees collected from PFCs for each enplaned passenger at the Airport could be applied to safety and security improvement projects included on the CIP. In addition to helping the Airport meet the local share necessary to receive federal funding for the extension of Runway 17/35, PFCs could help finance most projects listed on the CIP including the acquisition of a new ARFF vehicle and de-icing area modifications to accommodate additional aircraft. An increase in the $4.50 limit per enplaned passenger (which is being discussed by industry and government officials) would benefit the Airport as additional local funds could be generated for improvement projects.

6.3.d Customer Facility Charges – Customer Facility Charges (CFCs) are a local source of revenue set forth by an agreement with an airport and rental car concessionaires to collect a fee from rental car transactions to help finance the construction of car rental infrastructure such as QTA service facilities and parking garages. The level of these fees vary based upon an agreed level between the Airport and rental car concessionaires with method of collection ranging from a per transaction basis or a per transaction day basis. CFCs are not subject to federal or state requirements limiting the application of their use, or the fee amount that can be placed on a rental car transaction.

Entering into agreement with the rental car concessionaires would benefit the Airport in raising funds for the design and construction of a QTA service facility. Rental car concessionaires would be supportive in establishing a CFC as the need for a QTA facility is demonstrated in the long-term operation plans of each agency. In addition to offering a funding mechanism to construct a QTA service facility, CFCs could also be used to finance the construction of a rental car ready/return lot adjacent to the new terminal building in the future.

6.3.e Additional Airport Financing Sources – Revenue earned from other Airport funding sources that help finance the day-to-day operations of the Airport could also be utilized for improvement projects listed on the CIP. These sources of revenue include rents from commercial air carriers, concessionaires, Fixed Based Operators (FBOs), and hangar tenants; landing fees collected from aircraft operations; and automobile parking charges. Funds raised from these sources are not subject to federal or State requirements limiting their applicability and can be utilized to fund all improvement projects at the Airport.

Revenue available from these sources is most beneficial for projects that are not eligible to receive federal or State funding or are only able to take advantage of a limited portion of federal or State funds that are available. Funding gaps experienced in other improvement projects, such as the ability of PFCs and CFCs to meet the required local match, could also benefit from revenue earned through these additional resources. Projects on the Airport's CIP most likely to benefit from these additional funding sources, either because of ineligibility for federal or State funding or limited available funds, include the demolition of the former terminal building, construction of an employee parking lot, and construction of a rental car QTA service facility.

6.4 Summary

Development of a CIP allows an Airport to create an implementation schedule addressing the timing of future capital needs for proposed infrastructure improvements. In addition to identifying the level of financial, staffing, and scheduling resources needed for each improvement project, CIPs help demonstrate the short-, mid-, and long-term financial needs of an airport to federal, state, and local officials. Several funding resources made available through federal and State of Michigan programs or local mechanisms such as PFCs and CFCs are available to assist the Airport in raising the necessary capital for each improvement project. Periodic update of the CIP presented in this Chapter to reflect changing demands and priorities throughout the planning period will position the Airport well to continually meet the aviation demands of southwest Michigan.

Appendix A
Airport Layout Plan Drawing Set

Detroit Airports District Office
Metro Airport Center
11677 S. Wayne Road, Ste. 107
Romulus, MI 48174

Mr. Clifton Moshoginis, C.M.
Airport Director
Kalamazoo/Battle Creek International Airport
5235 Portage Road
Kalamazoo, MI 49002

Kalamazoo/Battle Creek International Airport
Airport Layout Plan Approval
ASN # 2012-AGL-5320-NRA

Dear Mr. Moshoginis:

The Master Plan (MP) documents for the Kalamazoo/Battle Creek International Airport are acceptable from a contractual standpoint with respect to the terms and conditions of the grant agreement. The contents of the MP reflect the views of the Kalamazoo/Battle Creek International Airport, who is responsible for the accuracy of the document. The MP does not necessarily reflect the views or policies of the Federal Aviation Administration (FAA), and the determination of acceptability does not imply the FAA agrees with the MP conclusions and recommendations.

Enclosed is a conditionally approved copy of the Airport Layout Plan (ALP) for the Kalamazoo/Battle Creek International Airport, dated August 2012. This letter cancels or supersedes all prior ALP approvals. The ALP approval is based on recognition of and adherence to the following:

The approval is not to be considered a commitment of Federal funding for the proposed development. The FAA has concurred with the proposed development for planning purposes only based on current safety, utility, and efficiency standards. Actual development should comply with approved standards applicable at the time of construction. The sponsor must provide the FAA with justification of need before seeking FAA financial participation in the development projects depicted on this ALP.

Design standard modifications were previously granted under airspace case number 84-AGL-81-NRA and are continued as part of this ALP approval as follows:

1. Railroad east side edge of 50:1 Approach Surface, Runway 35. FAA issued waiver July 23, 1979.

2. Equipment Shelter is in Runway Object Free Area of Runway 17 end is fixed by function.

If any of the design critical aircraft or aircraft groups change, this ALP must be reevaluated by the FAA. This ALP was reviewed in accordance with C-III design standards based on the current and future critical design aircraft.

Additional guidance concerning development depicted on this ALP was provided in the airspace review letter, dated December 11, 2012.

Sheet 8 entitled *Property Plan* has been included for informational purposes only and does not replace the required Exhibit A for grant assurance purposes.

Our approval does not infer or imply that the land in the airport vicinity is considered compatible with airport operations. Federal requirements stipulate:

1. All development programs should be reasonably consistent with the plans of local and state planning agencies for the development in the airport vicinity.
2. That fair consideration has been given to the interest of communities in or near the airport.
3. That development programs provide for the protection and enhancement of the environment.

The FAA offers no objections to the proposed ultimate airspace utilization as depicted on the ALP based on considerations of safe and efficient use of airspace. The ALP has the status of "Plan on File" for the purpose of 14 CFR 77, *Obstruction Evaluations*, and 14 CFR 152, *Airport Aid Program*. A review of the airside landing area development was conducted according to the following 14 CFR's: -77, -152, -and –157, *Notice of Construction, Alteration, Activation, and Deactivation of Airports* (reference Aeronautical Study Number 2012-AGL-5320-NRA). It should be noted that FAA cannot prevent erection of any structure near an airport. Airport environs can only be protected through state and local zoning ordinances, building regulations, and like requirements. To avoid conflicts with future development, we recommend that you utilize the ALP when preparing leases. We further recommend that you provide copies to state and local planning and zoning boards as well as county and city officials. We recommend that you encourage them to adopt compatible land use criteria in and around the airport. Copies should also be distributed to Fixed Base Operators and airport users.

All development depicted on this ALP must comply with the National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190) and have FAA environmental approval prior to construction. This applies to development, even if no FAA funding is involved. Additional requirements concerning FAA NEPA approval can be found in FAA Order 5050.4B, *"National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions."*

The Airport and Airway Improvement Act (49 USC 47107(a)(16)(D)) requires the sponsor to eliminate any adverse effects on Federal facilities, or bear all costs to relocate those facilities, that are a result of an airport change. However, if AIP eligible construction/development items adversely affect FAA facilities, the cost of relocating the facilities may be eligible under AIP.

This approval does not include a detailed evaluation of actual construction. Prior to constructing any development on the airport, notice (FAA Form 7460-1) consistent with 14 CFR 77 must be filed with this office. This approval does not include approval for temporary construction equipment which may be used during actual construction, e.g., cranes, equipment staging areas, site access routes, etc. A separate construction safety/phasing plan for any project should be reviewed by the FAA no less than 60 days prior to beginning any project. The airport must take all measures necessary during construction to ensure there are no runway incursions.

If development is planned without aviation trust fund investments that will change the status or geometrics of runways, taxiways, aprons, or other operating airport surfaces, notice (FAA Form 7480-1) must be filed with this office consistent with 14 CFR 157.

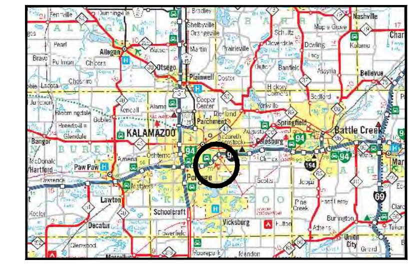
We trust this letter provides a clear explanation of the conditions and terms of our approval. If you desire further clarification, please contact our office at *734.229.2900*.

Sincerely,

John L. Mayfield, Jr.
Manager
Detroit Airports District Office

cc: Michigan – Office of Aeronautics

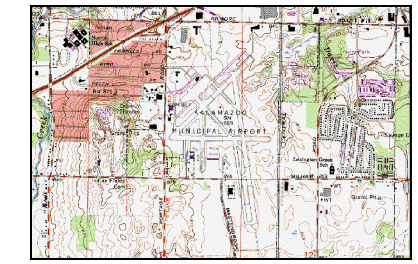
AIRPORT LOCATION MAP



Source: Michigan Department of Transportation

NO SCALE

AIRPORT VICINITY MAP

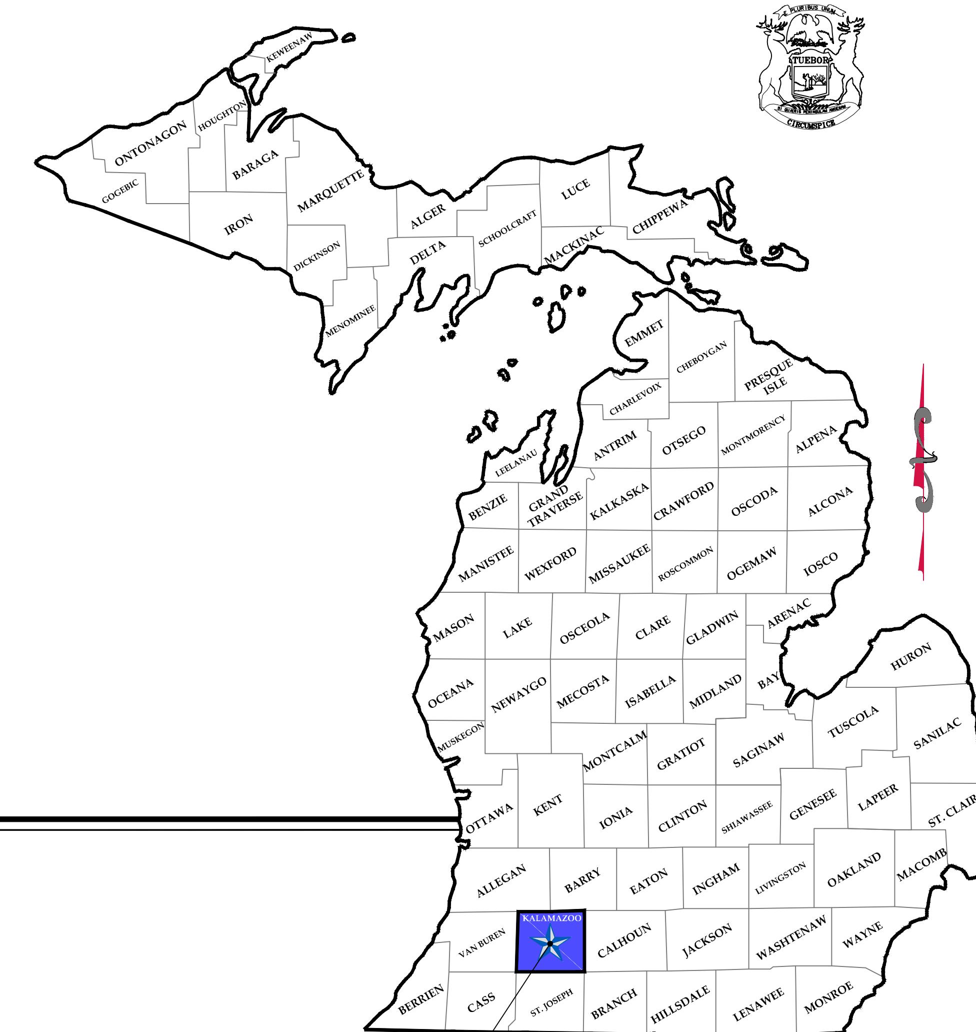


Source: USGS Map - Terrain Navigator Pro

NO SCALE

STATE OF MICHIGAN
DEPARTMENT OF TRANSPORTATION
OFFICE OF AERONAUTICS

LANSING



KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT

KALAMAZOO, MICHIGAN

AIRPORT LAYOUT PLAN - AUGUST 2012

COUNTY OF KALAMAZOO

APPROVED: ______________________ DATE

CLIFTON E. MOSHOGINIS
AIRPORT MANAGER

MICHIGAN AERONAUTICS COMMISSION

APPROVED: ______________________ DATE 3/28/13

DAVID L. BAKER, P.E.
AIP PROGRAMS SECTION MANAGER

APPROVED: ______________________ DATE 3-28-13

RICHARD E. HAMMOND
AIRPORTS DIVISION MANAGER

CERTIFICATION

ON BEHALF OF ***MEAD & HUNT, INC.*** I CERTIFY THAT THE ALP PREPARED FOR KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT WAS PREPARED ACCORDING TO THE APPLICABLE ADVISORY CIRCULARS. THE CURRENT VERSION OF THE GREAT LAKES REGION ALP CHECKLIST, AND ACCURATELY DEPICTS THE PROPOSED USE OF AIRSPACE AT THE TIME OF SUBMITTAL. THE ALP CONFORMS WITH FAA DESIGN STANDARDS, EXCEPT AS NOTED:

1. RAILROAD EAST SIDE EDGE OF 50:1 APPROACH SURFACE, RUNWAY 35; WAIVER ISSUED BY FAA ON JULY 23, 1979 (REFERENCE CASE NO. 84-AGL-81-MRA.

2. EQUIPMENT SHELTER IN OBJECT FREE AREA OR RUNWAY 17 IS FIXED BY FUNCTION.

APPROVED: ______________________ DATE 3-25-13

STEPHANIE A. D. WARD, SENIOR PLANNER
A.I.C.P. #014419

Mead & Hunt

MEAD & HUNT, INC.
2605 PORT LANSING ROAD
LANSING, MI 48906
phone: 517.321.8334
fax: 517.321.5932

APPROVED: ______________________ DATE 3/25/13

RON J. ENGEL
P.E. #030528

INDEX SHEETS

SHEET NUMBERS	SHEET NAME	REVISION DATE	SHEET NUMBERS	SHEET NAME	REVISION DATE
1	TITLE SHEET		13	FU. RUNWAY 35 APPROACH PLAN	
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3	EXISTING AIRPORT LAYOUT PLAN		15	FU. RUNWAY 5 APPROACH PLAN	
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7	FUTURE BUILDING AREA PLAN		19	FAR PART-77 PLAN	
8	PROPERTY PLAN				
9	LAND USE PLAN				
10	EX. RUNWAY 17 APPROACH PLAN				
11	FU. RUNWAY 17 APPROACH PLAN				
12	EX. RUNWAY 35 APPROACH PLAN				

FILE NUMBER: **39-02**

AIP GRANT NUMBER: 3-26-0052-3409

DESIGNED	SADW	06/01/11
DRAWN	AEF	06/01/11
CHECKED	SADW	10/07/11

SHEET: **1** OF **19**

April 15, 2013 - 01 Title.dwg

IF PAPER SIZE IS 24"x36" USE SCALE SHOWN. ALL OTHER PAPER SIZES ARE NOT TO SCALE.

RUNWAY DATA

ITEMS	EXISTING 17	FUTURE 17	EXISTING 35	FUTURE 35	EXISTING 5	EXISTING 23	EXISTING 9	FUTURE 9	EXISTING 27	FUTURE 27
RUNWAY LENGTH	6,502'	7,502'	6,502'	7,502'	3,438'	3,438'	2,800'	n/a	2,800'	n/a
DISPLACED THRESHOLD	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
EFFECTIVE LANDING LENGTH	6,502'	7,502'	6,502'	7,502'	3,438'	3,438'	2,800'	n/a	2,800'	n/a
RUNWAY WIDTH	150'	150'	150'	150'	100'	100'	60'	n/a	60'	n/a
PAVEMENT TYPE	ASPHALT	ASPHALT	ASPHALT	ASPHALT	ASPHALT	ASPHALT	ASPHALT	n/a	ASPHALT	n/a
PAVEMENT STRENGTH(1)	SW - 85,000 LBS DW - 121,000 LBS DT - 240,000 LBS	SW - 85,000 LBS DW - 121,000 LBS DT - 240,000 LBS	SW - 85,000 LBS DW - 121,000 LBS DT - 240,000 LBS	SW - 85,000 LBS DW - 121,000 LBS DT - 240,000 LBS	SW - 30,000 LBS DW - 45,000 LBS DT - 60,000 LBS	SW - 30,000 LBS DW - 45,000 LBS DT - 60,000 LBS	SW - 30,000 LBS DW - 60,000 LBS NOT RATED	n/a	SW - 30,000 LBS DW - 60,000 LBS NOT RATED	n/a
RUNWAY LIGHTING	HIRL	HIRL	HIRL	HIRL	MIRL	MIRL	MIRL	n/a	MIRL	n/a
RUNWAY MARKING	PRECISION	PRECISION	PRECISION	PRECISION	NON-PRECISION	NON-PRECISION	VISUAL	n/a	VISUAL	n/a
NAVIGATIONAL AIDS	VOR, RNAV(GPS), LOC-BC	VOR, RNAV (GPS), LPV	VOR, RNAV(GPS), NDB, ILS	VOR/GPS, NDB, ILS	VOR/GPS	VOR/GPS	NONE	n/a	NONE	n/a
RUNWAY APPROACH CATEGORY	C	C	C	C	B	B	B	n/a	B	n/a
RUNWAY DESIGN CRITERIA	III	III	III	III	II	II	I	n/a	I	n/a
APPROACH LIGHTING	REIL, PAPI	REIL, PAPI	PAPI, MALSR	PAPI, MALSR	PAPI, REIL	VASI, REIL	NONE	n/a	NONE	n/a
CRITICAL AIRCRAFT(2)	AIRBUS 320	AIRBUS 320	AIRBUS 320	AIRBUS 320	KING AIR, FALCON 900	KING AIR, FALCON 900(2)	CESSNA 172	n/a RUNWAY TO BE CLOSED	CESSNA 172	n/a RUNWAY TO BE CLOSED
FAR PART-77 APPROACH SURFACE RATIO	34:1	34:1	50:1	50:1	20:1(7)	20:1(7)	20:1	n/a	20:1	n/a
RUNWAY SAFETY AREA (RSA)	500' X 1,000'	500' X 1,000'	500' X 1,000'	500' X 1,000'	150' X 300'	150' X 300'	120' X 240'	n/a	120' X 240'	n/a
OBJECT FREE AREA (OFA)	800' X 1,000'	800' X 1,000'	800' X 1,000'	800' X 1,000'	300' X 500'	300' X 500'	240' X 400'	n/a	240' X 400'	n/a
OBSTACLE FREE ZONE (OFZ)	200' X 400'	200' X 400'	200' X 400'	200' X 400'	200' X 250'	200' X 250'	200' X 250'	n/a	200' X 250'	n/a
RUNWAY PROTECTION ZONE (RPZ)	500' X 1,010' X 1,700'	1,000' X 1,510' X 1,700'	1,000' X 1,750' X 2,500'	1,000' X 1,750' X 2,500'	500' X 700' X 1,000'	500' X 700' X 1,000'	250' X 450' X 1,000'	n/a	250' X 450' X 1,000'	n/a
FAR PART-77 APPROACH SURFACE	1,000' X 3,500' X 10,000'	1,000' X 4,000' X 10,000'	1,000' x 16,000' x 50,000'	1,000' x 16,000' x 50,000'	500' X 2,000' 5,000'(7)	500 X 2,000' X 5,000'(7)	250' X 1,250' X 5,000'	n/a	250' X 1,250' X 5,000'	n/a
APPROACH TYPE	NON-PRECISION	NON-PRECISION	PRECISION	PRECISION	NON-PRECISION	NON-PRECISION	VISUAL	n/a	VISUAL	n/a
APPROACH VISIBILITY MINIMUMS	500' AGL - 1 MI. RNAV (GPS)	TBD(3) - ¾ MI. LPV	200' AGL - ½ MI. LOC	TO BE DETERMINED(3)	400' AGL - 1 MI. GPS	500' AGL - 1 MI. GPS	VISUAL	n/a	VISUAL	n/a
RUNWAY END ELEVATIONS(4)	859'	859'(4)	868'	868'(4)	874'	851'	873'	n/a	863'	n/a
RUNWAY GRADIENT(5)	0.13	0.03	0.13	0.03(5)	0.66	0.66	0.35	n/a	0.35	n/a
RWY. END COORDINATE (LATITUDE)(6)	42° 14' 28.93"	42° 14' 28.94"	42° 13' 25.48"	42° 13' 15.72"	42° 14' 05.56"	42° 14' 29.61"	42° 14' 02.15"	n/a	42° 14' 02.13"	n/a
RWY. END COORDINATE (LONGITUDE)(6)	85° 33' 06.24"	85° 33' 06.24"	85° 32' 52.87"	85° 32' 50.81"	85° 33' 29.04"	85° 32' 56.77"	85° 33' 29.29"	n/a	85° 32' 52.07"	n/a
TAIL HEIGHT	30 - <45 FT.	30 - <45 FT.	30 - <45 FT.	30 - <45 FT.	20 - <30 FT.	20 - <30 FT.	<20	n/a	<20	n/a
TAXIWAY SAFETY AREA WIDTH	118'	118'	118'	118'	79'	79'	49'	n/a	49'	n/a
TAXIWAY LIGHTING	YES	YES	YES	YES	YES	YES	YES	n/a	YES	n/a

GLOSSARY OF ABBREVIATIONS:

HIRL	HIGH INTENSITY RUNWAY LIGHTS
ILS	INSTRUMENT LANDING SYSTEM
MALSR	MEDIUM INTENSITY APPROACH LIGHT SYSTEM WITH RUNWAY ALIGNMENT INDICATOR LIGHTS
MIRL	MEDIUM INTENSITY RUNWAY LIGHTS
NDB	NON-DIRECTIONAL RADIO BEACON
PAPI	PRECISION APPROACH PATH INDICATOR
REIL	RUNWAY END IDENTIFIER LIGHTS
VASI	VISUAL APPROACH SLOPE INDICATOR
ARP	AIRPORT REFERENCE POINT
BRL	BUILDING RESTRICTION LINE
CAT	CATEGORY OF INSTRUMENT APPROACH
RWY	RUNWAY
TWY	TAXIWAY
ASR	AIRPORT SURVEILLANCE RADAR
GPS	GLOBAL POSITIONING SYSTEM
VOR	VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE

GENERAL NOTES:

(THE NOTES BELOW CORRESPOND TO THE NUMBERS ABOVE)

1. EXISTING PAVEMENT STRENGTH SHOWN TAKES INTO CONSIDERATION WEIGHT OF MAINTENANCE EQUIPMENT AS WELL AS CRITICAL AIRCRAFT WEIGHT.
2. CRITICAL AIRCRAFT FOR FUTURE AND ULTIMATE RUNWAY DEVELOPMENT TO BE DETERMINED AT TIME OF CONSTRUCTION, OR AS FLEET MIX CHANGES.
3. FUTURE APPROACH VISIBILITY MINIMUMS TO BE DETERMINED AFTER COMPLETION OF FUTURE RUNWAY CONSTRUCTION.
4. FUTURE RUNWAY END ELEVATIONS ESTIMATED UNTIL TIME OF CONSTRUCTION.
5. FUTURE EFFECTIVE RUNWAY GRADIENT ESTIMATED UNTIL TIME OF CONSTRUCTION.
6. EXISTING RUNWAY END COORDINATE INFORMATION TAKEN FROM AIRPORT DATA (5010) AND BASED IN NAD83. (CURRENT AS OF 05/05/11)
7. EXISTING RUNWAY 5/23 IS CONSIDERED TO BE A UTILITY RUNWAY DUE TO THE 3,438 FEET LENGTH SERVING A MINIMAL NUMBER OF AIRCRAFT OVER 12,500 LB.

ADDITIONAL NOTES:

- CONSTRUCTION OF RUNWAY DEVELOPMENT TO BE DETERMINED AS FLEET MIX CHANGE AND JUSTIFICATION WARRANTS.
- THE WIDTHS OF THE RUNWAY SAFETY AREA, OBJECT FREE AREA AND OBSTACLE FREE ZONE ARE CENTERED ON THE RUNWAY AND EXTEND THE ENTIRE LENGTH OF THE RUNWAY.
- THE HORIZONTAL DATUM IS NAD83 WHILE THE VERTICAL DATUM IS NAVD88.
- THERE ARE NO OFZ PENETRATIONS.

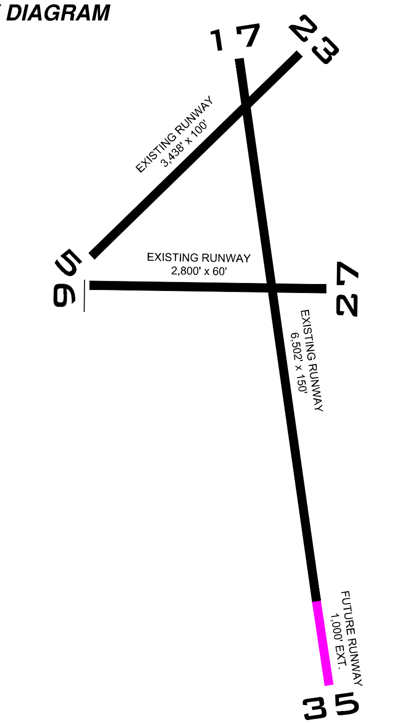
AIRPORT RUNWAY DIAGRAM

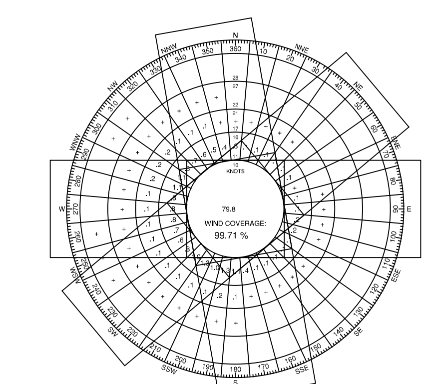
LEGEND

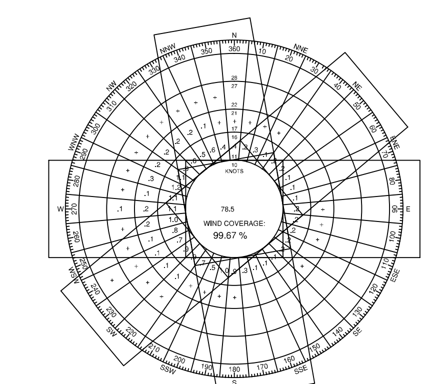
EXISTING

FUTURE

NOT TO SCALE







WIND COVERAGE TABLE - ALL WEATHER

RUNWAY	CROSSWIND COMPONENT - KNOTS 10.5	13.0	16.0	20.0
17/35	91.18	95.48	98.80	99.69
5/23	91.29	95.58	98.83	
9/27	90.68	95.09		
17/35,5/23 AND 9/27	99.71	99.95	99.99	99.99
17/35,5/23	96.81	99.02	99.76	99.99

SOURCE:
NATIONAL CLIMATIC DATA CENTER;
FAA AIRPORT DESIGN VERSION 4.2
MDOT BUREAU OF AERONAUTICS - 1994

NUMBER OF OBSERVATIONS:
81,040

PERIOD OF RECORD:
2000 - 2009

STATION:
KALAMAZOO, MI
STATION NUMBER: 72635

WIND COVERAGE TABLE - IFR

RUNWAY	CROSSWIND COMPONENT - KNOTS 10.5	13.0	16.0	20.0
17/35	89.32	94.34	98.49	99.66
5/23	90.42	95.06	98.51	
9/27	91.52	95.63		
17/35,5/23 AND 9/27	99.67	99.95	100.00	100.00
17/35,5/23	96.10	98.77	99.72	99.99

SOURCE:
NATIONAL CLIMATIC DATA CENTER;
FAA AIRPORT DESIGN VERSION 4.2
MDOT BUREAU OF AERONAUTICS - 1994

NUMBER OF OBSERVATIONS:
9,345

PERIOD OF RECORD:
2000 - 2009

STATION:
KALAMAZOO, MI
STATION NUMBER: 72635

AIRPORT DATA TABLE

ITEMS	EXISTING	FUTURE
AIRPORT REFERENCE POINT - LATITUDE	42° 14' 03.79"	42° 14' 00.26"
AIRPORT REFERENCE POINT - LONGITUDE	85° 33' 05.60"	85° 33' 03.04"
AIRPORT ELEVATION	874'	874'
AIRPORT & TERMINAL AIDS	ASR, VOR, ILS, BEACON, NDB, SEG. CIRC.	ASR, VOR, ILS, BEACON, NDB, SEG. CIRC.
SERVICE LEVEL	AIR CARRIER	AIR CARRIER
AIRPORT ROLE	AIR CARRIER	AIR CARRIER
AIRPORT REFERENCE CODE	C-III	C-III

ITEMS	
COUNTY	KALAMAZOO
TOWNSHIP	PORTAGE
MEAN MAX TEMPERATURE	84° F
TOWN	3S
RANGE	11W

DECLARED DISTANCE DATA TABLE

ITEMS	EXISTING 17	EXISTING 35	EXISTING 5	EXISTING 23	EXISTING 9	EXISTING 27
TAKE OFF RUN AVAILABLE (TORA)	6,502'	6,502'	3,438'	3,438'	2,800'	2,800'
TAKE OFF DISTANCE AVAILABLE (TODA)	6,502'	6,502'	3,438'	3,438'	2,800'	2,800'
LANDING DISTANCE AVAILABLE (LDA)	6,502'	6,502'	3,438'	3,438'	2,800'	2,800'
ACTIVE STOPPING DISTANCE AVAILABLE (ASDA)	6,502'	6,502'	3,438'	3,438'	2,800'	2,800'

PRIMARY AND SECONDARY AIRPORT CONTROL STATIONS (PACS AND SACS)

ITEMS	PAC - AZO G	PAC - AZO H	SAC - AZO I	SAC - AZO J	SAC - AZO K
LATITUDE	42° 14' 26.57" (N)	42° 14' 08.10" (N)	42° 13' 46.37" (N)	42° 13' 36.65" (N)	42° 13' 41.88" (N)
LONGITUDE	085° 33' 17.287" (W)	085° 33' 08.04" (W)	085° 33' 03.82" (W)	085° 33' 00.68" (W)	085° 32' 47.39" (W)
ELEVATION	864.58'	865.8'	865.9'	853.04'	864.0'

IF PAPER SIZE IS 24"x36" USE THE SCALE SHOWN. ALL OTHER PAPER SIZES ARE TO BE CONSIDERED NOT TO SCALE.

REVISIONS

NO.	DATE	REMARKS	BY	CHK
1				
2				
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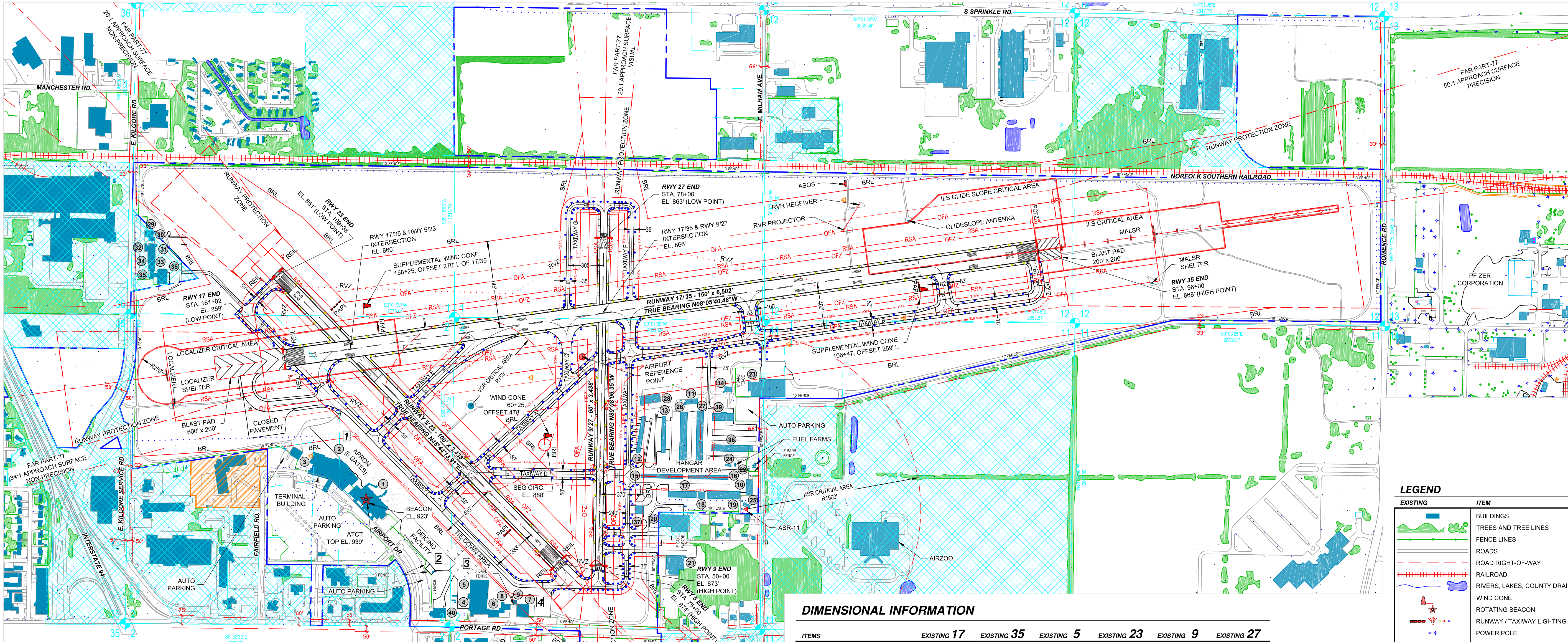
7				
8				
9				
10				

KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

AIRPORT LAYOUT PLAN
DATA SHEET

Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - 517.321.5932 FAX

STATE ID. NO.	M&H PROJECT NO. — 11139-00-09004	DESIGNED	SADW	06/01/11
39-02	FEDERAL CONTRACT NO. — ---	DRAWN	AEF	06/01/11
	STATE CONTRACT NO. — 3-26-0052-3409	CHECKED	SADW	10/07/11



RUNWAY DATA

ITEMS	EXISTING 17	EXISTING 35	EXISTING 5	EXISTING 23	EXISTING 9	EXISTING 27
LATITUDE (LAT.)	42° 14' 28.93"	42° 13' 25.48"	42° 14' 05.56"	42° 14' 29.61"	42° 14' 02.15"	42° 14' 02.13"
LONGITUDE (LONG.)	85° 33' 06.24"	85° 32' 52.87"	85° 33' 29.04"	85° 32' 56.77"	85° 33' 29.29"	85° 32' 52.07"
ELEVATION (EL.)	859'	868'	874'	851'	873'	863'
STATION (STA.)	161+02	96+00	75+00	109+38	50+00	78+00
TRUE BEARING	N08°05'40.48"W	N08°05'40.48"W	N45°44'13.91"E	N45°44'13.91"E	N89°08'06.35"W	N89°08'06.35"W
APPROACH TYPE	NON-PRECISION	PRECISION	NON-PRECISION	NON-PRECISION	VISUAL	VISUAL
TOUCHDOWN ZONE ELEVATION	866' 131+01	868' 96+00	874' 75+00	874' 79+38	873' 50+00	873' 50+00

AIRPORT REFERENCE POINT

ITEMS	EXISTING
LATITUDE (LAT.)	42° 14' 03.79"
LONGITUDE (LONG.)	85° 33' 05.60"
ELEVATION (EL.)	874'
STATION ALONG RWY 17/35	133+79
OFFSET FROM RUNWAY 17/35	347' L
STATION ALONG RUNWAY 9/27	67+81
OFFSET FROM RUNWAY 9/27	167' L

APRON DATA

	1	2	3	4
APRON DESC.	TERMINAL	DEICING AREA	TIE-DOWN AREA	GENERAL AVIATION
SIZE	1,434' x 304'	588' x 160'	374' x 224'	245' x 190'

NOTES:
APRONS MAY VARY IN SHAPE, THEREFORE, THE SIZE SHOWN ABOVE IS CALCULATED FROM POINTS THAT MAKE UP THE LARGEST RECTANGULAR SHAPE FOR EACH AREA.

RUNWAY SAFETY AREA

ITEMS	EXISTING 17	EXISTING 35	EXISTING 5	EXISTING 23	EXISTING 9	EXISTING 27
RUNWAY PROTECTION ZONE (RPZ)	500' X 1,010' X 1,700'	1,000' X 1,750' X 2,500'	500' X 700' X 1,000'	500' X 700' X 1,000'	250' X 450' X 1,000'	250' X 450' X 1,000'
FAR PART-77 APPROACH SURFACE	1,000' X 3,500' X 10,000'(1)	1,000' x 16,000' x 50,000'	500' X 2,000' 5,000'	500 X 2,000' X 5,000'	250' X 1,250' X 5,000'	250' X 1,250' X 5,000'
RUNWAY SAFETY AREA (RSA)	500' X 1,000'	500' X 1,000'	150' X 300'	150' X 300'	120' X 240'	120' X 240'
OBJECT FREE AREA (OFA)	800' X 1,000'	800' X 1,000'	300' X 500'	300' X 500'	240' X 400'	240' X 400'
OBSTACLE FREE ZONE (OFZ)	200' X 400'	200' X 400'	200' X 250'	200' X 250'	200' X 250'	200' X 250'
PRECISION OBSTACLE FREE ZONE(2) (POFZ)	n/a	200' x 800'	n/a	n/a	n/a	n/a

NOTES:
1. THE EXISTING RWY 17 APPROACH SURFACE INNER WIDTH DIMENSION CORRESPONDS TO THE WIDTH OF THE PRIMARY SURFACE WHICH IS REGULATED BY THE RWY 35 APPROACH SURFACE.
2. THE "PRECISION OBSTACLE FREE ZONE" IS IN EFFECT ONLY WHEN ALL OF THE FOLLOWING OPERATIONAL CONDITIONS ARE MET:
   - VERTICAL GUIDED APPROACH
   - REPORTED CEILING BELOW 250 FEET AND/OR VISIBILITY LESS THAN 3/4 STATUTE MILE (OR RVR BELOW 4,000 FEET)
   - AN AIRCRAFT ON FINAL APPROACH WITHIN TWO MILES OF THE RUNWAY THRESHOLD

GENERAL NOTES:

1. AIRPORT PROPERTY IS LOCATED WITHIN THE CITY OF KALAMAZOO, WITHIN SECTIONS 1, 2, 12, 11, 35, and 36 OF THE CITY OF PORTAGE, KALAMAZOO COUNTY, MICHIGAN (T.3S-R.11W).
2. AERIAL PHOTOGRAPHY AND BASE INFORMATION PROVIDED BY **WOOLPERT, LLP.** DATE OF PHOTOGRAPHY: 06/28/10.
3. AIRPORT PROPERTY LINE SURVEY, AVIGATION EASEMENTS, AND RELATED INFORMATION PROVIDED BY PREIN & NEWHOF (DEC 2003).
4. THE NORTH MAGNETIC DECLINATION WAS CALCULATED USING INFORMATION FOUND ON **WWW.NGDC.NOAA.GOV/SEG/GEOMAG/DECLINATION**. THESE CALCULATED FIGURES ARE BASED ON THE INTERNATIONAL GEOMAGNETIC REFERENCE FIELD MODEL, VERSION 10 (2005-2010). DECLINATION AND VARIANCE CALCULATED: 02/09/2011.
5. CONTACT "MISS DIG" PRIOR TO ANY CONSTRUCTION TO DETERMINE THE LOCATION OF BELOW GROUND UTILITIES.
6. MORE DETAILED FACILITY DEVELOPMENT INFORMATION AND SIZES ARE SHOWN ON BUILDING AREA PLAN.
7. HEIGHT OF PERIMETER FENCE VARIES AND SHOULD BE CONFIRMED WITH AIRPORT SPONSOR REGARDING HEIGHTS AT SPECIFIC LOCATIONS.
8. THE TAXIWAY HOTSPOTS IDENTIFIED BY THE OFFICE OF RUNWAY SAFETY TO BE EVALUATED WITH FUTURE GRANT FUNDS, OR TO BE RESOLVED BY THE PROPOSED CLOSURE OF RWY 9/27.
9. THE TAXIWAY OBJECT FREE AREAS ARE SHOWN ON THE BUILDING AREA PLAN AND APPROACH PLANS.

DIMENSIONAL INFORMATION

ITEMS	EXISTING 17	EXISTING 35	EXISTING 5	EXISTING 23	EXISTING 9	EXISTING 27
RUNWAY LENGTH	6,502'	6,502'	3,438'	3,438'	2,800'	2,800'
RUNWAY WIDTH	150'	150'	100'	100'	60'	60'
RUNWAY SHOULDER WIDTH	20'	20'	20'	20'	20'	20'
TAXIWAY WIDTH	50'	50'	50'	50'	35'	35'
TAXIWAY EDGE SAFETY MARGIN	10.0'	10.0'	7.5'	7.5'	5.0'	5.0'
TAXIWAY SHOULDER WIDTH	20'	20'	20'	20'	n/a	n/a
TAXIWAY SAFETY AREA WIDTH	118'	118'	79'	79'	49'	49'
TAXIWAY OBJECT FREE AREA WIDTH	186'	186'	131'	131'	89'	89'
RUNWAY CENTERLINE TO TAXIWAY HOLD LINE	250'	250'	75'	75'	60'	60'
RUNWAY CENTERLINE TO TAXIWAY CENTERLINE LENGTH	400'	400'	400'/388'	400'/388'	300'/240'	300'/240'
RUNWAY CENTERLINE TO BUILDING RESTRICTION LINE LENGTH	745'	745'	370'	370'	370'	370'

BUILDING DATA TABLE

NO.	DESCRIPTION	HEIGHT (AGL)	TOP EL. (MSL)	NO.	DESCRIPTION	HEIGHT (AGL)	TOP EL. (MSL)
1	FORMER TERMINAL BLDG & ATCT	53'	698'	23	KALAMAZOO AIR MUSEUM	52'	926'
2	TERMINAL BLDG	49'	719'	24	FUEL STATION - SELF SERVICE	11'	879'
3	ARFF	31'	701'	25	ASR STORAGE BUILDING	14'	882'
4	DUNCAN AVIATION FBO HANGAR	39'	706'	26	T-HANGAR #10 (20 UNIT)	21'	887'
5	DUNCAN AVIATION FBO HANGAR	30'	709'	27	T-HANGAR #11 (20 UNIT)	17'	883'
6	DUNCAN AVIATION FBO HANGAR	30'	702'	28	SRE BUILDING	23'	887'
7	DUNCAN AVIATION FBO HANGAR	30'	694'	29	WMU HANGAR	20'	870'
8	DUNCAN AVIATION FBO OFFICE	20'	718'	30	WMU OFFICE	15'	865'
9	DUNCAN AVIATION LINE OFFICE	10'	686'	31	WMU HANGAR	20'	870'
10	KALAMAZOO AVIATION FBO	36'	706'	32	WMU OFFICE	15'	865'
11	STORAGE BUILDING	26'	693'	33	WMU HANGAR	20'	870'
12	T-HANGAR #4 (11 UNIT)	14'	692'	34	WMU HANGAR	20'	870'
13	T-HANGAR #5 (11 UNIT)	14'	692'	35	WMU OFFICE	15'	865'
14	SAND STORAGE BUILDING	26'	686'	36	WMU HANGAR	34'	884'
15	T-HANGAR #2 (11 UNIT)	16'	706'	37	BOX HANGAR	28'	896'
16	T-HANGAR #3 (11 UNIT)	18'	693'	38	T-HANGAR (16 UNIT)	23'	887'
17	T-HANGAR #8	24'	692'	39	T-HANGAR (6 UNIT)	21'	885'
18	HANGAR #6	29'	692'	40	RILEY AVIATION HANGAR	29'	896'
19	T-HANGAR #12 (6 UNIT)	28'	692'				
20	KALAMAZOO AIR ZOO	40'	908'				
21	HINMAN HANGAR	43'	913'				
22	FUEL STORAGE FACILITY	26'	892'				

NOTES:
1. "AGL" STANDS FOR ABOVE GROUND LEVEL
2. "MSL" STANDS FOR MEAN SEA LEVEL

LEGEND

EXISTING	ITEM
	BUILDINGS
	TREES AND TREE LINES
	FENCE LINES
	ROADS
	ROAD RIGHT-OF-WAY
	RAILROAD
	RIVERS, LAKES, COUNTY DRAINS
	WIND CONE
	ROTATING BEACON
	RUNWAY / TAXIWAY LIGHTING
	POWER POLE
	AIRPORT PROPERTY LINE
	PROPERTY PARCELS
	SECTION LINES
	AVIGATION EASEMENT
	LAND RELEASE
	RUNWAYS, TAXIWAYS, PARKING
	RUNWAY MARKINGS
	CENTERLINES
	RUNWAY PROTECTION ZONE
RSA	RUNWAY SAFETY AREA
OFA	OBJECT FREE AREA
OFZ	OBSTACLE FREE ZONE
	APPROACH SURFACE
BRL	BUILDING RESTRICTION LINE
RVZ	RUNWAY VISIBILITY ZONE

MAGNETIC DECLINATION

N

SCALE:
1 INCH = 400 FEET
0 200 400 800

MAGNETIC DECLINATION:
5° 19' W, 0° 4' W
PER YEAR AS OF 02/09/2011

REVISIONS

NO.	DATE	REMARKS	BY	CHK
1				
2				
3				
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8				
9				
10				

KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

AIRPORT LAYOUT PLAN
EXISTING AIRPORT LAYOUT PLAN

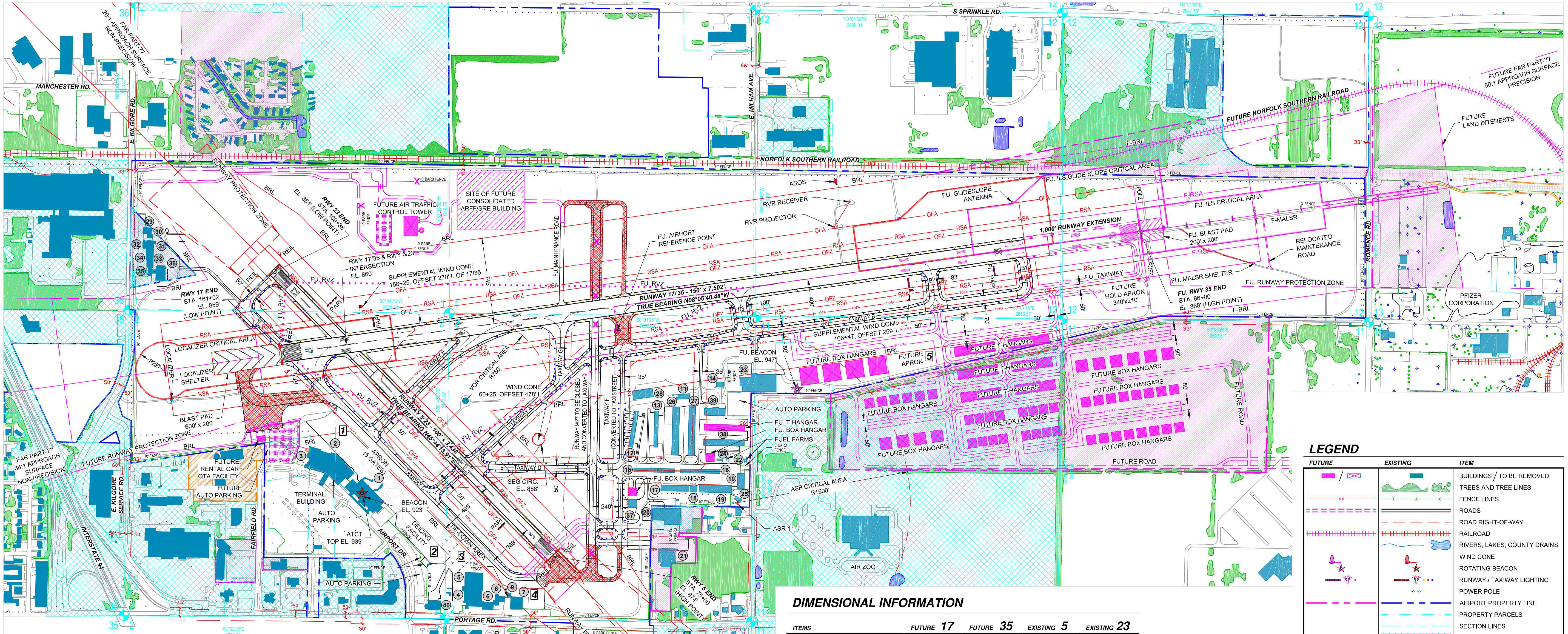
Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - 517.321.5932 FAX

STATE ID. NO.	M&H PROJECT NO. — 11139-00-09004	DESIGNED	SADW	06/01/11
39-02	FEDERAL CONTRACT NO. — ---	DRAWN	AEF	06/01/11
	STATE CONTRACT NO. — 3-26-0052-3409	CHECKED	SADW	10/07/11

SHEET: 3 OF 19

March 28, 2013 - 03 Existing ALP.dwg

IF PAPER SIZE IS 24"x36" USE SCALE SHOWN. ALL OTHER PAPER SIZES ARE NOT TO SCALE.



RUNWAY DATA

ITEMS	FUTURE 17	FUTURE 35	EXISTING 5	EXISTING 23
LATITUDE (LAT.)	42° 14' 28.93"	42° 13' 15.72"	42° 14' 05.56"	42° 14' 29.61"
LONGITUDE (LONG.)	85° 33' 06.24"	85° 32' 50.81"	85° 33' 29.04"	85° 32' 56.77"
ELEVATION (EL.)	859'	868'	874'	851'
STATION (STA.)	161+02	86+00	75+00	109+38
TRUE BEARING	N08°05'40.48"W	N08°05'40.48"W	N45°44'13.91"E	N45°44'13.91"E
APPROACH TYPE	NON-PRECISION	PRECISION	NON-PRECISION	NON-PRECISION
TOUCHDOWN ZONE ELEVATION	866' 131+01	868' 96+00	874' 75+00	874' 79+38

RUNWAY SAFETY AREA

ITEMS	FUTURE 17	FUTURE 35	EXISTING 5	EXISTING 23
RUNWAY PROTECTION ZONE (RPZ)	1,000' X 1,510' X 1,700'	1,000' X 1,750' X 2,500'	500' X 700' X 1,000'	500' X 700' X 1,000'
FAR PART-77 APPROACH SURFACE	1,000' X 4,000' X 10,000'	1,000' x 16,000' x 50,000'	500' X 2,000' 5,000'	500 X 2,000' X 5,000'
RUNWAY SAFETY AREA (RSA)	500' X 1,000'	500' X 1,000'	150' X 300'	150' X 300'
OBJECT FREE AREA (OFA)	800' X 1,000'	800' X 1,000'	300' X 500'	300' X 500'
OBSTACLE FREE ZONE (OFZ)	200' X 400'	200' X 400'	200' X 250'	200' X 250'
PRECISION OBSTACLE FREE ZONE(1) (POFZ)	n/a	200' x 800'	n/a	n/a

NOTES:
1. THE PRECISION OBSTACLE FREE ZONE IS IN EFFECT ONLY WHEN ALL OF THE FOLLOWING OPERATIONAL CONDITIONS ARE MET:
   - VERTICAL GUIDED APPROACH
   - REPORTED CEILING BELOW 250 FEET AND/OR VISIBILITY LESS THAN 3/4 STATUTE MILE (OR RVR BELOW 4,000 FEET)
   - AN AIRCRAFT ON FINAL APPROACH WITHIN TWO MILES OF THE RUNWAY THRESHOLD

AIRPORT REFERENCE POINT

ITEMS	FUTURE
LATITUDE (LAT.)	42° 14' 00.26"
LONGITUDE (LONG.)	85° 33' 03.04"
ELEVATION (EL.)	874'
STATION ALONG RWY 17/35	131+97
OFFSET FROM RUNWAY 17/35	211' R

APRON DATA

	1	2	3	4	5
APRON DESC.	TERMINAL	DEICING AREA	TIE-DOWN AREA	GENERAL AVIATION	GENERAL AVIATION
SIZE	1,434' x 304'	588' x 160'	374' x 224'	245' x 190'	465' x 315'

NOTES:
APRONS MAY VARY IN SHAPE, THEREFORE, THE SIZE SHOWN ABOVE IS CALCULATED FROM POINTS THAT MAKE UP THE LARGEST RECTANGULAR SHAPE FOR EACH AREA.

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5. CONTACT "MISS DIG" PRIOR TO ANY CONSTRUCTION TO DETERMINE THE LOCATION OF BELOW GROUND UTILITIES.
6. MORE DETAILED FACILITY DEVELOPMENT INFORMATION AND SIZES ARE SHOWN ON BUILDING AREA PLAN.
7. HEIGHT OF PERIMETER FENCE VARIES AND SHOULD BE CONFIRMED WITH AIRPORT SPONSOR REGARDING HEIGHTS AT SPECIFIC LOCATIONS.
8. THE TAXIWAY HOTSPOTS IDENTIFIED BY THE OFFICE OF RUNWAY SAFETY TO BE EVALUATED WITH FUTURE GRANT FUNDS, OR TO BE RESOLVED BY THE PROPOSED CLOSURE OF RWY 9/27.
9. THE TAXIWAY OBJECT FREE AREAS ARE SHOWN ON THE BUILDING AREA PLAN AND APPROACH PLANS.
10. AN ENVIRONMENTAL ASSESSMENT MAY BE NECESSARY PRIOR TO ANY FUTURE CONSTRUCTION.
11. FUTURE RAILROAD ALIGNMENT AROUND THE FUTURE RUNWAY 35 SAFETY AREA TO BE DETERMINED.

DIMENSIONAL INFORMATION

ITEMS	FUTURE 17	FUTURE 35	EXISTING 5	EXISTING 23
RUNWAY LENGTH	7,502'	7,502'	3,438'	3,438'
RUNWAY WIDTH	150'	150'	100'	100'
RUNWAY SHOULDER WIDTH	20'	20'	20'	20'
TAXIWAY WIDTH	50'	50'	50'	50'
TAXIWAY EDGE SAFETY MARGIN	10.0'	10.0'	7.5'	7.5'
TAXIWAY SHOULDER WIDTH	20'	20'	20'	20'
TAXIWAY SAFETY AREA WIDTH	118'	118'	79'	79'
TAXIWAY OBJECT FREE AREA WIDTH	186'	186'	131'	131'
RUNWAY CENTERLINE TO TAXIWAY HOLD LINE	250'	250'	75'	75'
RUNWAY CENTERLINE TO TAXIWAY CENTERLINE LENGTH	400'	400'	400'/388'	400'/388'
RUNWAY CENTERLINE TO BUILDING RESTRICTION LINE LENGTH	745'	745'	370'	370'

BUILDING DATA TABLE

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3	FORMER ARFF BLDG	31'	701'	25	ASR STORAGE BUILDING	14'	882'
4	DUNCAN AVIATION FBO HANGAR	39'	706'	26	T-HANGAR #10 (20 UNIT)	21'	887'
5	DUNCAN AVIATION FBO HANGAR	30'	709'	27	T-HANGAR #11 (20 UNIT)	17'	883'
6	DUNCAN AVIATION FBO HANGAR	30'	702'	28	SRE BUILDING	23'	887'
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13	T-HANGAR #5 (11 UNIT)	14'	692'	35	WMU OFFICE	15'	865'
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NOTES:
1. "AGL" STANDS FOR ABOVE GROUND LEVEL
2. "MSL" STANDS FOR MEAN SEA LEVEL

LEGEND

FUTURE	EXISTING	ITEM
		BUILDINGS / TO BE REMOVED
		TREES AND TREE LINES
		FENCE LINES
		ROADS
		ROAD RIGHT-OF-WAY
		RAILROAD
		RIVERS, LAKES, COUNTY DRAINS
		WIND CONE
		ROTATING BEACON
		RUNWAY / TAXIWAY LIGHTING
		POWER POLE
		AIRPORT PROPERTY LINE
		PROPERTY PARCELS
		SECTION LINES
		AVIGATION EASEMENT
		LAND RELEASE
		LAND ACQUISITION
		RUNWAYS, TAXIWAYS, PARKING
		RUNWAY MARKINGS
		PAVEMENT TO BE REMOVED
		CENTERLINES
		RUNWAY PROTECTION ZONE
F-RSA	RSA	RUNWAY SAFETY AREA
F-OFA	OFA	OBJECT FREE AREA
F-OFZ	OFZ	OBSTACLE FREE ZONE
		APPROACH SURFACE
F-BRL	BRL	BUILDING RESTRICTION LINE
F-RVZ	RVZ	RUNWAY VISIBILITY ZONE

MAGNETIC DECLINATION

SCALE:
1 INCH = 400 FEET
0 200 400 800

MAGNETIC DECLINATION:
5° 19' W, 0° 4' W
PER YEAR AS OF 02/09/2011

REVISIONS

NO.	DATE	REMARKS	BY	CHK
1				
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KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

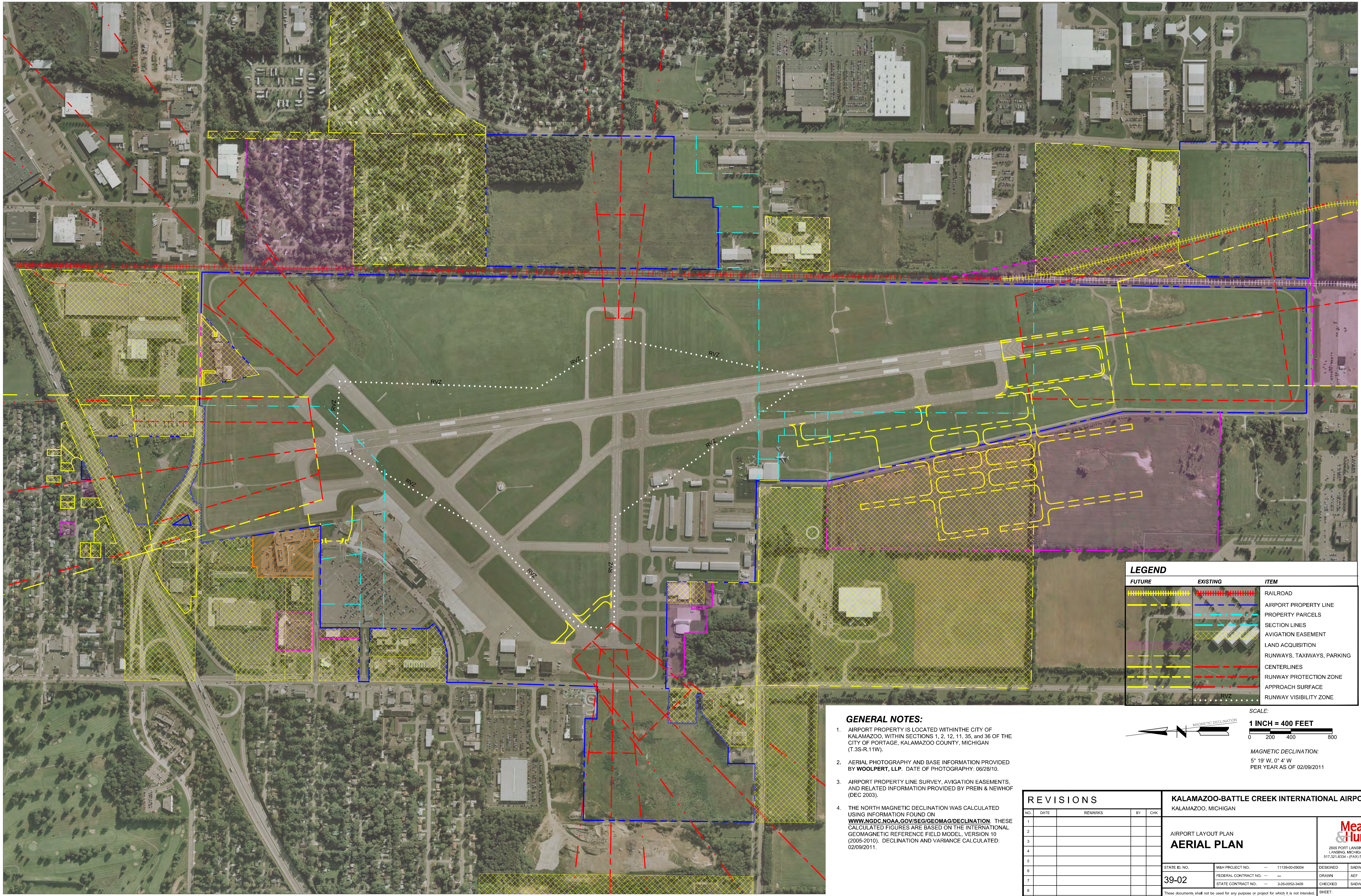
AIRPORT LAYOUT PLAN
FUTURE AIRPORT LAYOUT PLAN

Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - (FAX) 517.321.5932

STATE ID. NO.	M&H PROJECT NO. —	11139-00-09004	DESIGNED	SADW	06/01/11
39-02	FEDERAL CONTRACT NO. —	---	DRAWN	AEF	06/01/11
	STATE CONTRACT NO. —	3-26-0052-3409	CHECKED	SADW	10/07/11

March 28, 2013 - 04 Future ALP.dwg

IF PAPER SIZE IS 24"x36" USE SCALE SHOWN. ALL OTHER PAPER SIZES ARE NOT TO SCALE.



LEGEND

FUTURE	EXISTING	ITEM
		RAILROAD
		AIRPORT PROPERTY LINE
		PROPERTY PARCELS
		SECTION LINES
		AVIGATION EASEMENT
		LAND ACQUISITION
		RUNWAYS, TAXIWAYS, PARKING
		CENTERLINES
		RUNWAY PROTECTION ZONE
		APPROACH SURFACE
	RVZ	RUNWAY VISIBILITY ZONE

MAGNETIC DECLINATION

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0 200 400 800

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KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

AIRPORT LAYOUT PLAN
AERIAL PLAN

Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - (FAX) 517.321.5932

STATE ID. NO.			DESIGNED	SADW	06/01/11
39-02	M&H PROJECT NO. —	11139-00-09004			
	FEDERAL CONTRACT NO. —	--	DRAWN	AEF	06/01/11
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March 28, 2013 - 05 Aerial Plan.dwg

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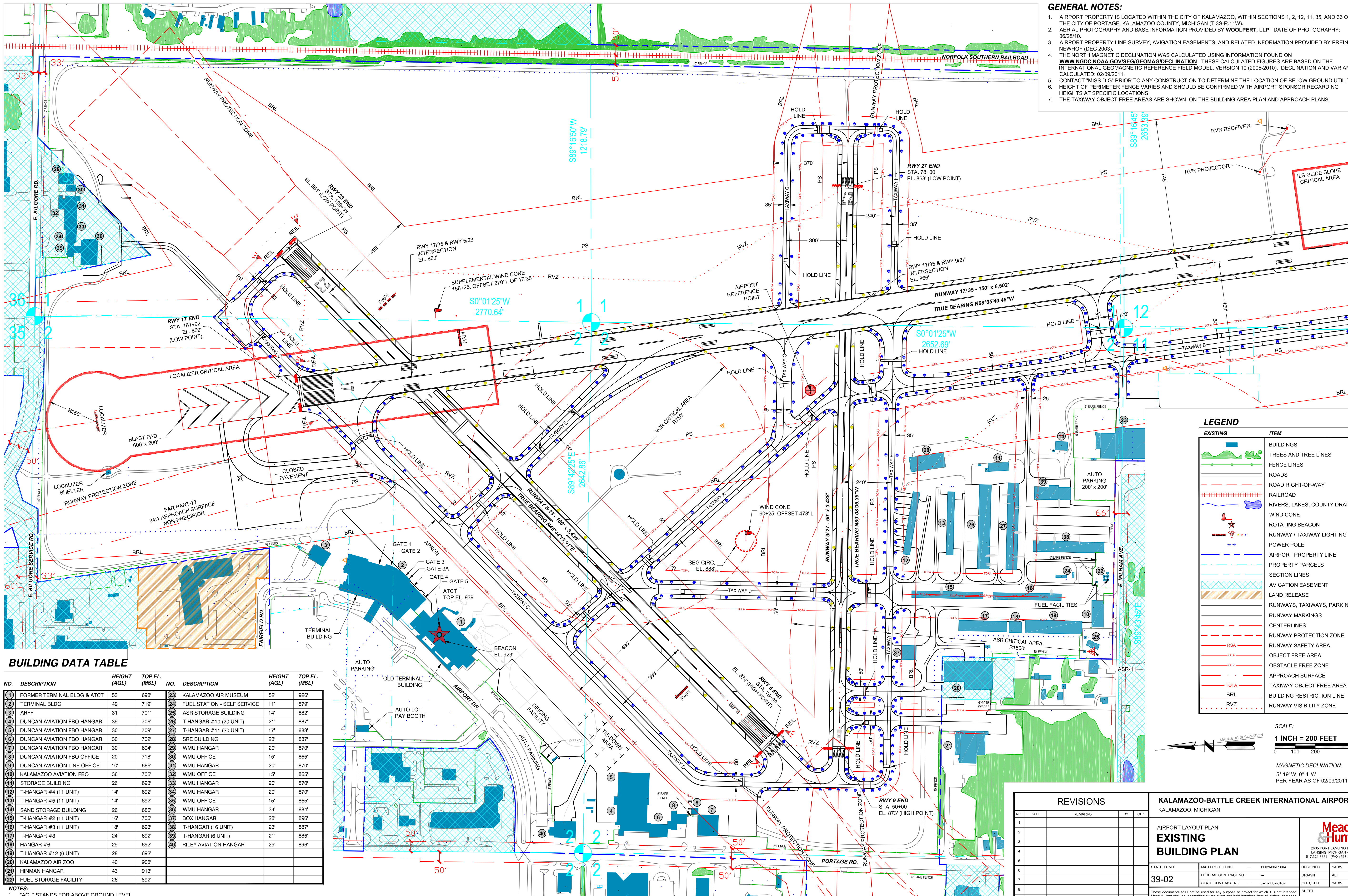

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LEGEND

EXISTING	ITEM
	BUILDINGS
	TREES AND TREE LINES
	FENCE LINES
	ROADS
	ROAD RIGHT-OF-WAY
	RAILROAD
	RIVERS, LAKES, COUNTY DRAINS
	WIND CONE
	ROTATING BEACON
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BRL	BUILDING RESTRICTION LINE
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MAGNETIC DECLINATION

SCALE:

1 INCH = 200 FEET

0 100 200 400

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5° 19' W, 0° 4' W
PER YEAR AS OF 02/09/2011

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NOTES:
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2. "MSL" STANDS FOR MEAN SEA LEVEL

April 2, 2013 - 06 Existing Building Plan.dwg

IF PAPER SIZE IS 24"x36" USE SCALE SHOWN. ALL OTHER PAPER SIZES ARE NOT TO SCALE.

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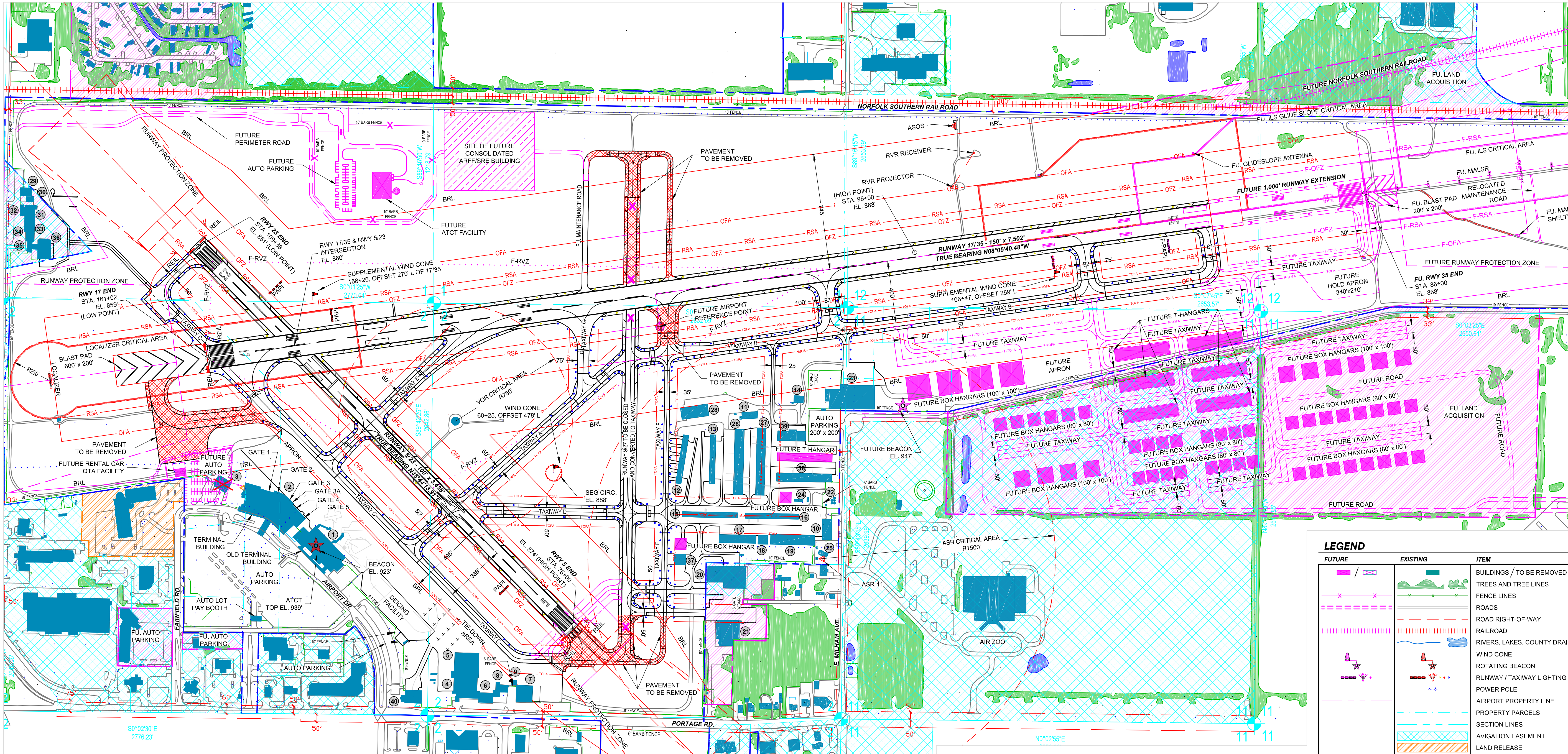
KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

AIRPORT LAYOUT PLAN
EXISTING BUILDING PLAN

Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - (FAX) 517.321.5932

STATE ID. NO.			
39-02	M&H PROJECT NO.	—	11139-00-09004
	FEDERAL CONTRACT NO.	—	---
	STATE CONTRACT NO.	—	3-26-0052-3409

DESIGNED	SADW	06/01/11
DRAWN	AEF	06/01/11
CHECKED	SADW	10/07/11



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March 28, 2013 - 07 Future Building Plan.dwg

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MAGNETIC DECLINATION

SCALE:
1 INCH = 300 FEET
0 150 300 600

MAGNETIC DECLINATION:
5° 19' W, 0° 4' W
PER YEAR AS OF 02/09/2011

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LEGEND

FUTURE	EXISTING	ITEM
		BUILDINGS / TO BE REMOVED
		TREES AND TREE LINES
		FENCE LINES
		ROADS
		ROAD RIGHT-OF-WAY
		RAILROAD
		RIVERS, LAKES, COUNTY DRAINS
		WIND CONE
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		PROPERTY PARCELS
		SECTION LINES
		AVIGATION EASEMENT
		LAND RELEASE
		LAND ACQUISITION
		RUNWAYS, TAXIWAYS, PARKING
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		PAVEMENT TO BE REMOVED
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F-RPZ		RUNWAY PROTECTION ZONE
F-RSA	RSA	RUNWAY SAFETY AREA
F-OFA	OFA	OBJECT FREE AREA
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F-BRL	BRL	BUILDING RESTRICTION LINE
F-RVZ	RVZ	RUNWAY VISIBILITY ZONE

REVISIONS

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KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

AIRPORT LAYOUT PLAN
FUTURE BUILDING PLAN

Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
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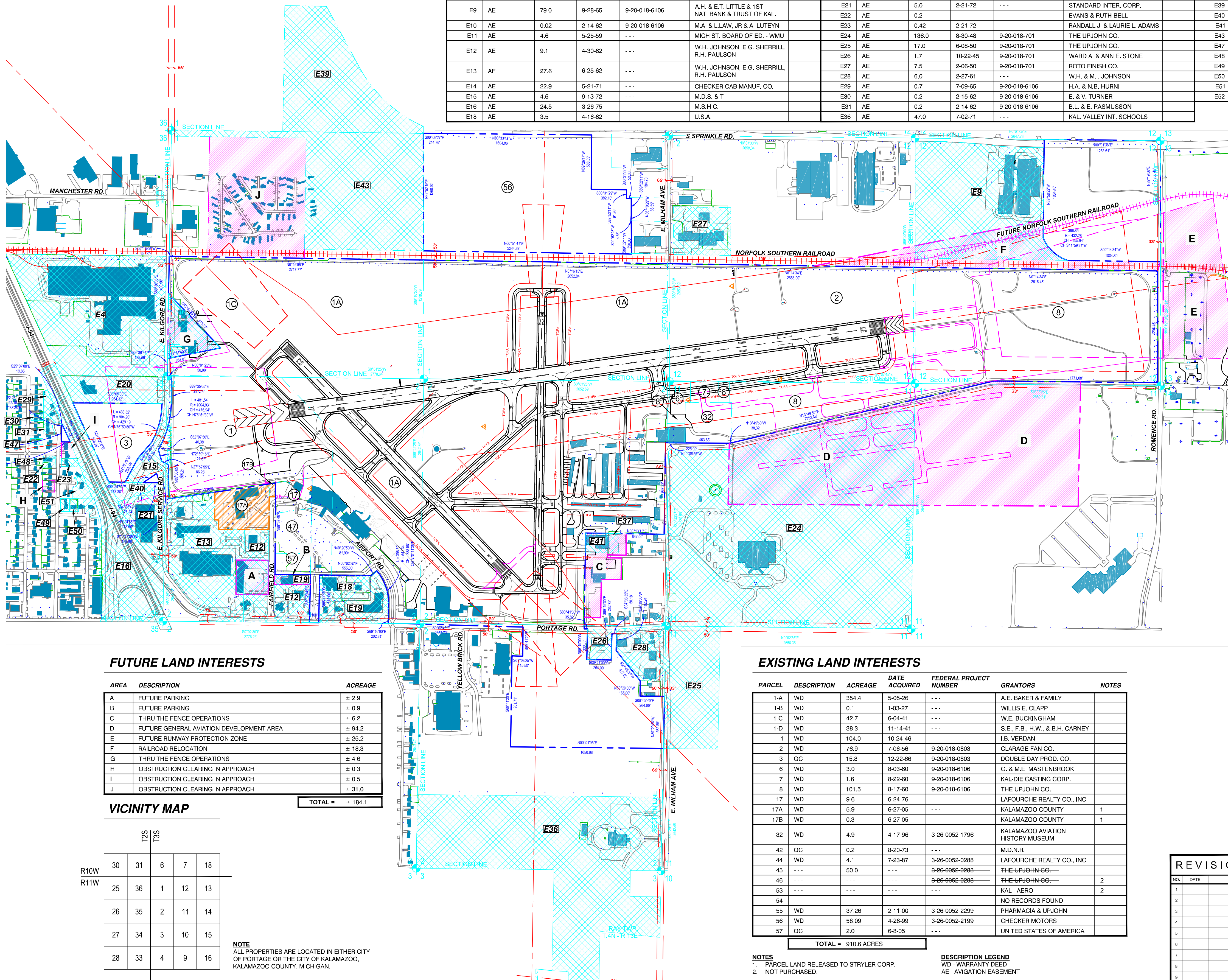
	STATE CONTRACT NO. —	3-26-0052-3409	CHECKED	SADW	10/07/11

EXISTING EASEMENT INTERESTS

PARCEL	DESCRIPTION	ACREAGE	DATE ACQUIRED	FEDERAL PROJECT NUMBER	GRANTORS	NOTES
E4	AE	42.0	3-22-65	9-20-018-6106	BRUNSWICK PROPERTIES, INC	
E5	AE	- - -	- - -	- - -	CONRAIL	
E9	AE	79.0	9-28-65	9-20-018-6106	A.H. & E.T. LITTLE & 1ST NAT. BANK & TRUST OF KAL.	
E10	AE	0.02	2-14-62	9-20-018-6106	M.A. & L.LAW, JR & A. LUTEYN	
E11	AE	4.6	5-25-59	- - -	MICH ST. BOARD OF ED. - WMU	
E12	AE	9.1	4-30-62	- - -	W.H. JOHNSON, E.G. SHERRILL, R.H. PAULSON	
E13	AE	27.6	6-25-62	- - -	W.H. JOHNSON, E.G. SHERRILL, R.H. PAULSON	
E14	AE	22.9	5-21-71	- - -	CHECKER CAB MANUF. CO.	
E15	AE	4.6	9-13-72	- - -	M.D.S. & T	
E16	AE	24.5	3-26-75	- - -	M.S.H.C.	
E18	AE	3.5	4-16-62		U.S.A.	
E19	AE	7.0	6-24-76	- - -	LAFOURCHE REALTY CO, INC.	
E20	AE	6.8	8-19-76	- - -	ATLAS RENT-A-TRUCK	
E21	AE	5.0	2-21-72	- - -	STANDARD INTER. CORP.	
E22	AE	0.2	- - -	- - -	EVANS & RUTH BELL	
E23	AE	0.42	2-21-72	- - -	RANDALL J. & LAURIE L. ADAMS	
E24	AE	136.0	8-30-48	9-20-018-701	THE UPJOHN CO.	
E25	AE	17.0	6-08-50	9-20-018-701	THE UPJOHN CO.	
E26	AE	1.7	10-22-45	9-20-018-701	WARD A. & ANN E. STONE	
E27	AE	7.5	2-06-50	9-20-018-701	ROTO FINISH CO.	
E28	AE	6.0	2-27-61	- - -	W.H. & M.I. JOHNSON	
E29	AE	0.7	7-09-65	9-20-018-6106	H.A. & N.B. HURNI	
E30	AE	0.2	2-15-62	9-20-018-6106	E. & V. TURNER	
E31	AE	0.2	2-14-62	9-20-018-6106	B.L. & E. RASMUSSON	
E36	AE	47.0	7-02-71	- - -	KAL. VALLEY INT. SCHOOLS	
E37	AE	8' WIDE	8-21-72	- - -	W-L MOLDING GROUP	
E38	AE	8' WIDE	9-15-72	- - -	W.M.U. BD. OF TRUSTEES	
E39	AE	31.0	9-07-71	- - -	COLONIAL ACRES CO.	
E40	AE	1.6	12-01-58	- - -	DOUBLE PRODUCTS CO.	
E41	AE	1.1	11-29-63	- - -	LAKALA AVIATION	
E43	AE	39.2	4-21-80	- - -	R.M. & S.C. BROWN	
E47	AE	0.19	- - -	9-20-0052-1192	RICHARD A. & FRANCIS L. HUNT	
E48	AE	0.2	8-21-91	9-20-0052-1192	ROSALENE RICHARDS	
E49	AE	0.3	11-07-91	9-20-0052-1192	BRIAN L. & CYNTHIA A. CRANDALL	
E50	AE	0.3	9-04-91	9-20-0052-1192	RICHARD W. & PAULA K. ZANG	
E51	AE	0.7	9-16-91	9-20-0052-1192	JAMES E. & JERI A. SILMAN	
E52	AE	0.3	9-17-91	9-20-0052-1192	MICHAEL A. & DOLLY F. STEFFES	

TOTAL = 528.3 ACRES

"DESCRIPTION" LEGEND
WD - WARRANTY DEED
AE - AVIGATION EASEMENT



FUTURE LAND INTERESTS

AREA	DESCRIPTION	ACREAGE
A	FUTURE PARKING	± 2.9
B	FUTURE PARKING	± 0.9
C	THRU THE FENCE OPERATIONS	± 6.2
D	FUTURE GENERAL AVIATION DEVELOPMENT AREA	± 94.2
E	FUTURE RUNWAY PROTECTION ZONE	± 25.2
F	RAILROAD RELOCATION	± 18.3
G	THRU THE FENCE OPERATIONS	± 4.6
H	OBSTRUCTION CLEARING IN APPROACH	± 0.3
I	OBSTRUCTION CLEARING IN APPROACH	± 0.5
J	OBSTRUCTION CLEARING IN APPROACH	± 31.0
	TOTAL =	± 184.1

VICINITY MAP

	T2S	T3S			
R10W	30	31	6	7	18
R11W	25	36	1	12	13
	26	35	2	11	14
	27	34	3	10	15
	28	33	4	9	16

NOTE
ALL PROPERTIES ARE LOCATED IN EITHER CITY OF PORTAGE OR THE CITY OF KALAMAZOO, KALAMAZOO COUNTY, MICHIGAN.

EXISTING LAND INTERESTS

PARCEL	DESCRIPTION	ACREAGE	DATE ACQUIRED	FEDERAL PROJECT NUMBER	GRANTORS	NOTES
1-A	WD	354.4	5-05-26	- - -	A.E. BAKER & FAMILY	
1-B	WD	0.1	1-03-27	- - -	WILLIS E. CLAPP	
1-C	WD	42.7	6-04-41	- - -	W.E. BUCKINGHAM	
1-D	WD	38.3	11-14-41	- - -	S.E., F.B., H.W., & B.H. CARNEY	
1	WD	104.0	10-24-46	- - -	I.B. VERDAN	
2	WD	76.9	7-06-56	9-20-018-0803	CLARAGE FAN CO.	
3	QC	15.8	12-22-66	9-20-018-0803	DOUBLE DAY PROD. CO.	
6	WD	3.0	8-03-60	9-20-018-6106	G. & M.E. MASTENBROOK	
7	WD	1.6	8-22-60	9-20-018-6106	KAL-DIE CASTING CORP.	
8	WD	101.5	8-17-60	9-20-018-6106	THE UPJOHN CO.	
17	WD	9.6	6-24-76	- - -	LAFOURCHE REALTY CO., INC.	
17A	WD	5.9	6-27-05	- - -	KALAMAZOO COUNTY	1
17B	WD	0.3	6-27-05	- - -	KALAMAZOO COUNTY	1
32	WD	4.9	4-17-96	3-26-0052-1796	KALAMAZOO AVIATION HISTORY MUSEUM	
42	QC	0.2	8-20-73	- - -	M.D.N.R.	
44	WD	4.1	7-23-87	3-26-0052-0288	LAFOURCHE REALTY CO., INC.	
45	- - -	50.0	- - -	~~3-26-0052-0288~~	~~THE UPJOHN CO.~~	
46	- - -	- - -	- - -	~~3-26-0052-0288~~	~~THE UPJOHN CO.~~	2
53	- - -	- - -	- - -	- - -	KAL - AERO	2
54	- - -	- - -	- - -	- - -	NO RECORDS FOUND	
55	WD	37.26	2-11-00	3-26-0052-2299	PHARMACIA & UPJOHN	
56	WD	58.09	4-26-99	3-26-0052-2199	CHECKER MOTORS	
57	QC	2.0	6-8-05	- - -	UNITED STATES OF AMERICA	

TOTAL = 910.6 ACRES

NOTES
1. PARCEL LAND RELEASED TO STRYLER CORP.
2. NOT PURCHASED.

DESCRIPTION LEGEND
WD - WARRANTY DEED
AE - AVIGATION EASEMENT

LEGEND

FUTURE	EXISTING	ITEM
		BUILDINGS / TO BE REMOVED
		FENCE LINES
		ROADS
		ROAD RIGHT-OF-WAY
		RAILROAD
		POWER POLE
		AIRPORT PROPERTY LINE
		PROPERTY PARCELS
		SECTION LINES
		UTILITY EASEMENT
D	1	PARCEL IDENTIFICATION NUMBER
	E1	EASEMENT IDENTIFICATION NUMBER
	36 1 / 35 2	SECTION CORNER
		AVIGATION EASEMENT
		LAND RELEASE
		LAND ACQUISITION
		RUNWAYS, TAXIWAYS, PARKING
		RUNWAY MARKINGS
		CENTERLINES
		RUNWAY PROTECTION ZONE
F-BRL	BRL	BUILDING RESTRICTION LINE

MAGNETIC DECLINATION

SCALE:

1 INCH = 500 FEET

0 250 500 1000

MAGNETIC DECLINATION:

5° 19' W, 0° 4' W
PER YEAR AS OF 02/09/2011

GENERAL NOTES:

1. AIRPORT PROPERTY IS LOCATED WITHIN THE CITY OF KALAMAZOO, WITHIN SECTIONS 1, 2, 12, 11, 35, and 36 OF THE CITY OF PORTAGE, KALAMAZOO COUNTY, MICHIGAN (T.3S-R.11W).
2. AIRPORT PROPERTY LINE SURVEY, AVIGATION EASEMENTS, AND RELATED INFORMATION PROVIDED BY PREIN & NEWHOF (DEC 2003).

REVISIONS

NO.	DATE	REMARKS	BY	CHK
1				
2				
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KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

AIRPORT LAYOUT PLAN
PROPERTY PLAN

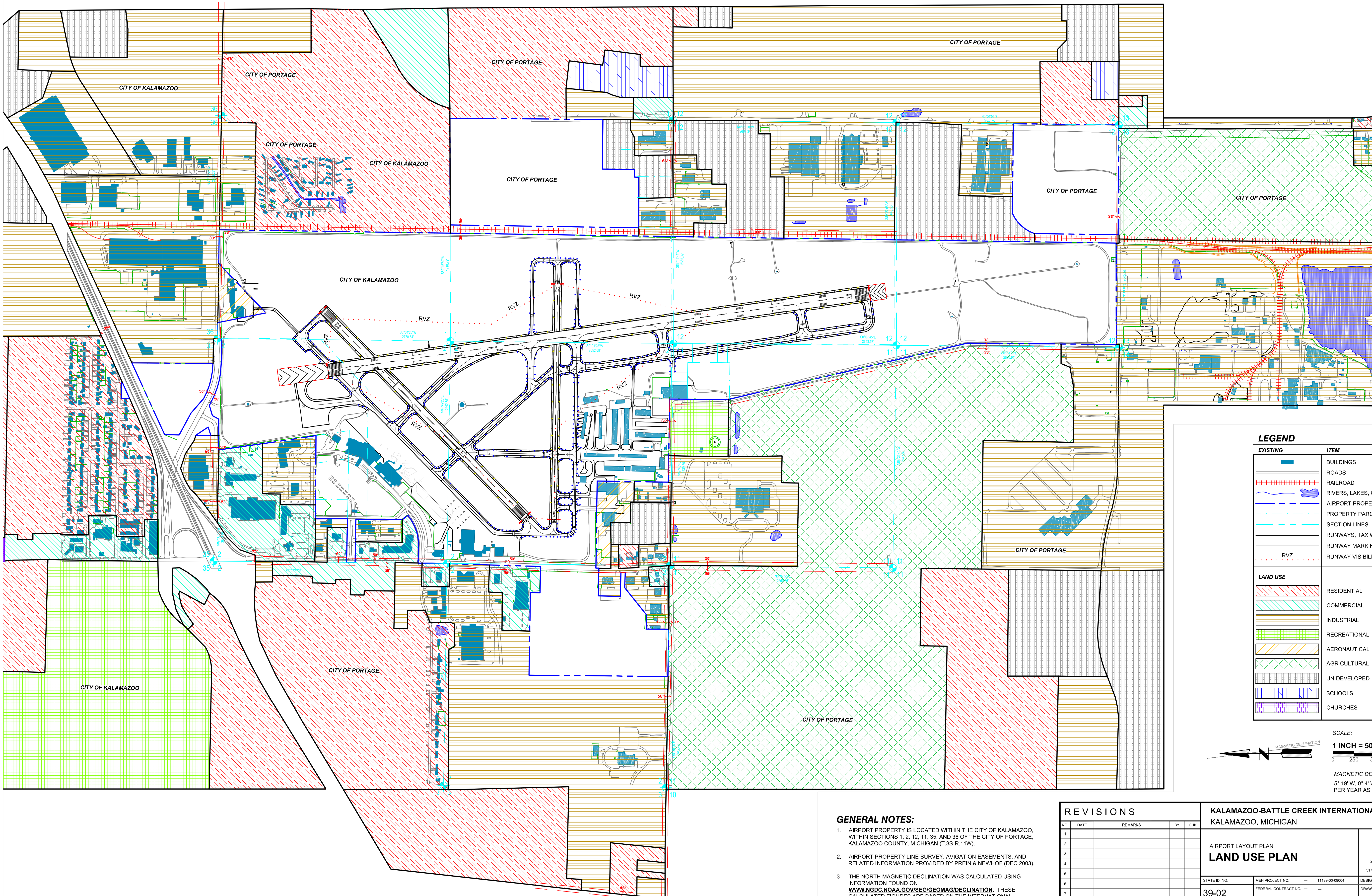
Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - (FAX) 517.321.5932

STATE ID. NO.		
39-02	M&H PROJECT NO. —	11139-00-09004
	FEDERAL CONTRACT NO. —	---
	STATE CONTRACT NO. —	3-26-0052-3409

DESIGNED	SADW	06/01/11
DRAWN	AEF	06/01/11
CHECKED	SADW	10/07/11

March 28, 2013 - 08 Property Plan.dwg

IF PAPER SIZE IS 24"x36" USE SCALE SHOWN. ALL OTHER PAPER SIZES ARE NOT TO SCALE.



LEGEND

EXISTING	ITEM
	BUILDINGS
	ROADS
	RAILROAD
	RIVERS, LAKES, COUNTY DRAINS
	AIRPORT PROPERTY LINE
	PROPERTY PARCELS
	SECTION LINES
	RUNWAYS, TAXIWAYS, PARKING
	RUNWAY MARKINGS
RVZ	RUNWAY VISIBILITY ZONE

LAND USE

	RESIDENTIAL
	COMMERCIAL
	INDUSTRIAL
	RECREATIONAL
	AERONAUTICAL
	AGRICULTURAL
	UN-DEVELOPED
	SCHOOLS
	CHURCHES

MAGNETIC DECLINATION

SCALE:

1 INCH = 500 FEET

0 250 500 1000

MAGNETIC DECLINATION:

5° 19' W, 0° 4' W
PER YEAR AS OF 02/09/2011

GENERAL NOTES:

1. AIRPORT PROPERTY IS LOCATED WITHIN THE CITY OF KALAMAZOO, WITHIN SECTIONS 1, 2, 12, 11, 35, AND 36 OF THE CITY OF PORTAGE, KALAMAZOO COUNTY, MICHIGAN (T.3S-R.11W).
2. AIRPORT PROPERTY LINE SURVEY, AVIGATION EASEMENTS, AND RELATED INFORMATION PROVIDED BY PREIN & NEWHOF (DEC 2003).
3. THE NORTH MAGNETIC DECLINATION WAS CALCULATED USING INFORMATION FOUND ON **WWW.NGDC.NOAA.GOV/SEG/GEOMAG/DECLINATION**. THESE CALCULATED FIGURES ARE BASED ON THE INTERNATIONAL GEOMAGNETIC REFERENCE FIELD MODEL, VERSION 10 (2005-2010). DECLINATION AND VARIANCE CALCULATED: 02/09/2011.

REVISIONS

NO.	DATE	REMARKS	BY	CHK
1				
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KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

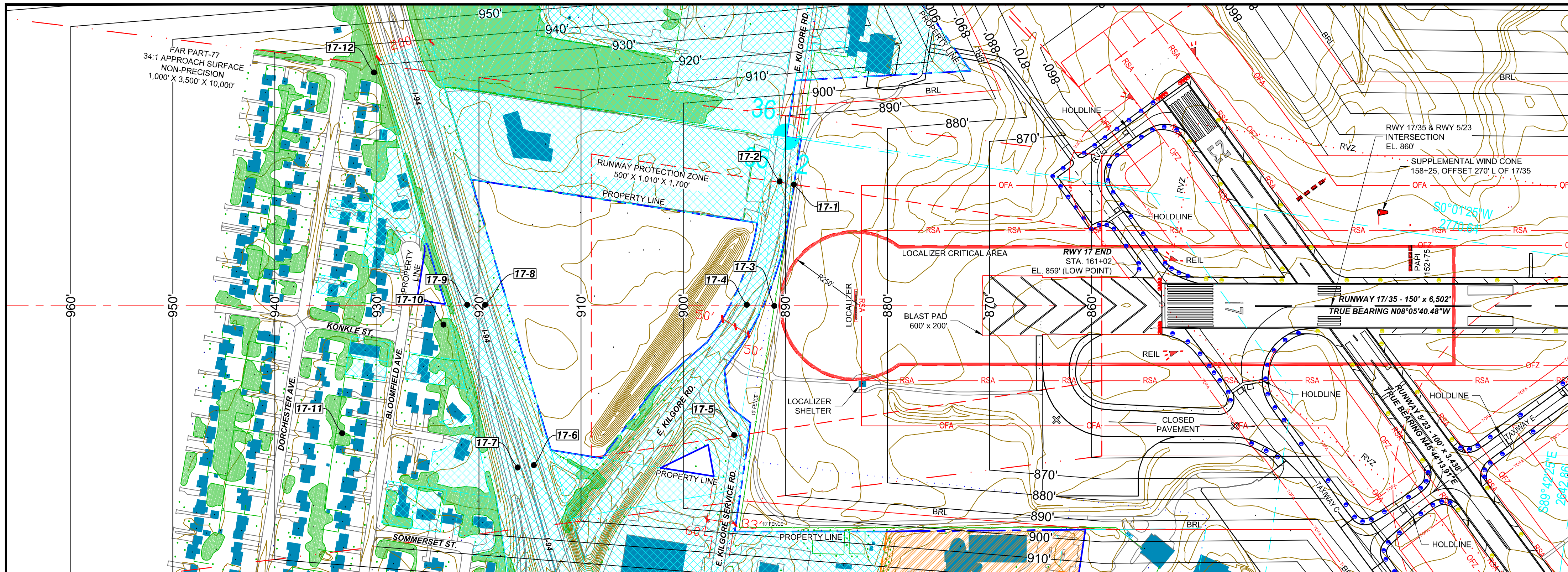
AIRPORT LAYOUT PLAN
LAND USE PLAN

Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - 517.321.5932 FAX

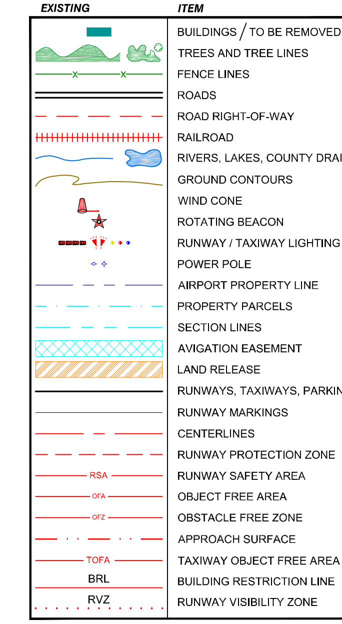
STATE ID. NO.				
39-02	M&H PROJECT NO. — 11139-00-09004	DESIGNED	SADW	06/01/11
	FEDERAL CONTRACT NO. — ---	DRAWN	AEF	06/01/11
	STATE CONTRACT NO. — 3-26-0052-3409	CHECKED	SADW	10/07/11

March 28, 2013 - 09 Land Use Plan.dwg

IF PAPER SIZE IS 24"x36" USE SCALE SHOWN. ALL OTHER PAPER SIZES ARE NOT TO SCALE.



LEGEND



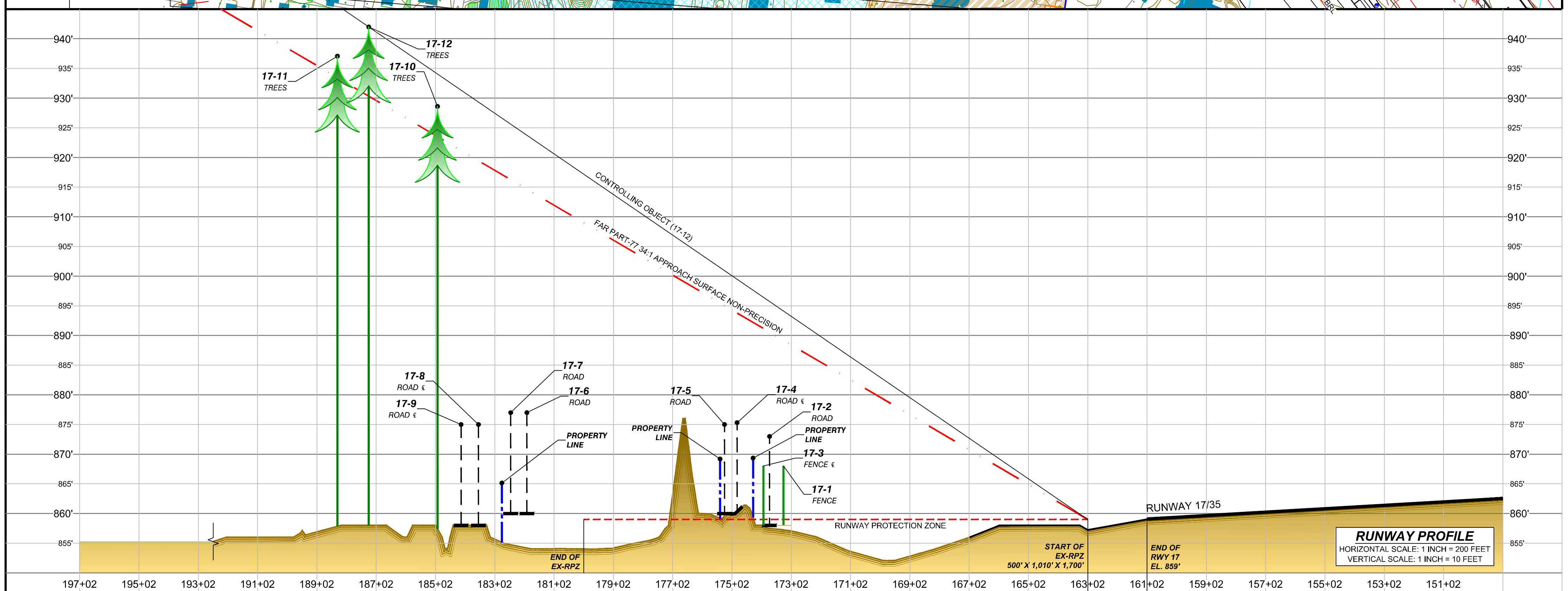
SCALE:

1 INCH = 200 FEET

0 100 200 400

MAGNETIC DECLINATION:

5° 19' W, 0° 4' W
PER YEAR AS OF 02/09/2011



OBSTRUCTION TABLE

NO.	DESCRIPTION	TOP EL.	ALLOWABLE EL.	PENETRATION	DISPOSITION	SURFACE IMPACTED
17-1	FENCE	868'	889'	-21'	REMAIN	RPZ, AS
17-2	ROAD	873'	891'	-18'	REMAIN	RPZ, AS
17-3	FENCE	868'	891'	-23'	REMAIN	RPZ, AS
17-4	ROAD	875'	894'	-19'	REMAIN	RPZ, AS
17-5	ROAD	875'	895'	-20'	REMAIN	RPZ, AS
17-6	ROAD	877'	915'	-38'	REMAIN	AS
17-7	ROAD	877'	916'	-39'	REMAIN	AS
17-8	ROAD	875'	919'	-44'	REMAIN	AS
17-9	ROAD	875'	921'	-46'	REMAIN	AS
17-10	TREE	929'	924'	5'	REMOVE	AS
17-11	TREE	937'	933'	4'	REMOVE	AS
17-12	TREE	942'	930'	12'	REMOVE	AS

NOTES:
1. THE "TOP EL." AND "ALLOWABLE EL." ELEVATIONS ARE SHOWN AT "MEAN SEA LEVEL" (MSL).
2. THE "PENETRATION" ELEVATIONS ARE SHOWN AT "ABOVE GROUND LEVEL" (AGL).
3. THE TOP ELEVATION FOR ROADS INCLUDES THE FAR PART-77 15' CLEARANCE OVER ROADS REQUIREMENT.

GENERAL NOTES:

1. BASE DATA AND OBSTRUCTION SURVEY PROVIDED BY WOOLPERT, LLP. (JUNE 2010)
2. OBJECTS IN THE TRANSITIONAL SURFACE DESIGNATED BY THE SYMBOL "( )TS".
3. OBSTRUCTION MITIGATION IN THE TRANSITIONAL SURFACE NOT OWNED BY THE AIRPORT SHOULD BE CLEARED AS FUNDS BECOME AVAILABLE.
4. FINAL DISPOSITION OF TREES TO BE "MITIGATED" WILL BE DETERMINED AT TIME OF CONSTRUCTION. FINAL DISPOSITION (PRUNING OR REMOVAL) WILL BE BASED UPON ACTUAL HEIGHT OF TREES AND PREFERENCE OF OWNER.
5. ORDER OF IMPORTANCE FOR LOCATION OF THE OBSTRUCTION:
   1. RUNWAY AREA
   2. PRIMARY SURFACE (PS)
   3. OBJECT FREE AREA (OFA) / RUNWAY SAFETY AREA (RSA)
   4. RUNWAY PROTECTION ZONE (RPZ)
   5. APPROACH SLOPE (AS)
   6. TRANSITIONAL SURFACE (TS)

"OBSTRUCTION TABLE" LEGEND

NO.	OBJECT LABEL ON APPROACH SHEET
DESCRIPTION	TYPE OF OBJECT - (EX. ROAD, TREES, BUILDINGS)
TOP ELEVATION	HIGHEST POINT OF OBJECT
ALLOWABLE ELEVATION	ELEVATION ALLOWED BY THE RUNWAY SURFACE - (EX. RPZ, AS, TS)
PENETRATION	TOTAL AMOUNT OF OBJECT LOCATED WITHIN APPROACH SURFACE
DISPOSITION	THE DETERMINATION OF WHAT ACTION TO TAKE WITH REFERENCE TO THE OBJECT
SURFACE IMPACTED	THE OBJECTS LOCATION RELATIVE TO THE FAR PART-77 APPROACH SURFACES SURROUNDING THE RUNWAY

"DISPOSITION" LEGEND

REMAIN	THE OBJECT IS LOCATED WITHIN A RUNWAY SURFACE; HOWEVER, IT DOES NOT PENETRATE THE APPROACH SURFACE.
REMOVE	THE OBJECT IS CONSIDERED AN OBSTRUCTION AND SHOULD BE COMPLETELY REMOVED.
PRUNE	THE OBJECT IS A TREE WHICH NEEDS TO BE PRUNED IN ORDER TO MAINTAIN HEIGHT CLEARANCE DUE TO MINIMAL IMPACT INTO THE FAR PART-77 APPROACH SURFACE.

"SURFACE" LEGEND

RPZ	RUNWAY PROTECTION ZONE
AS	APPROACH SURFACE
TS	TRANSITIONAL SURFACE

REVISIONS

NO.	DATE	REMARKS	BY	CHK
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KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

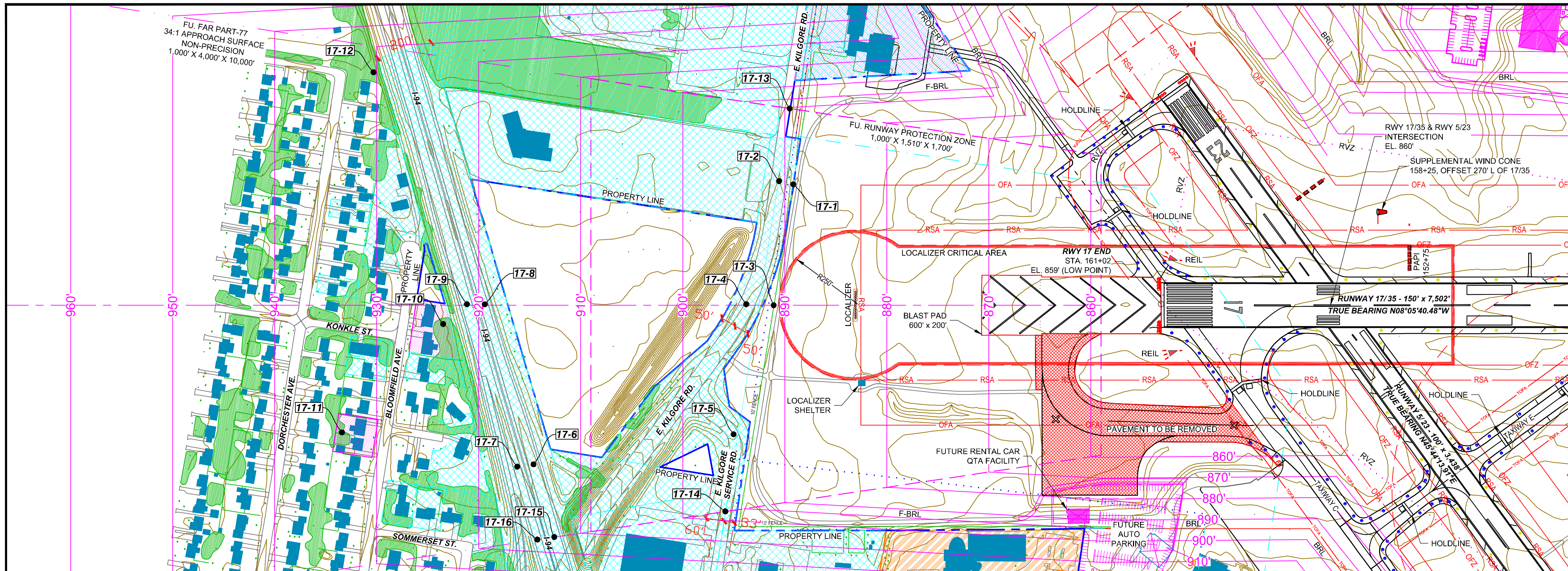
AIRPORT LAYOUT PLAN
EXISTING RUNWAY 17 APPROACH PLAN

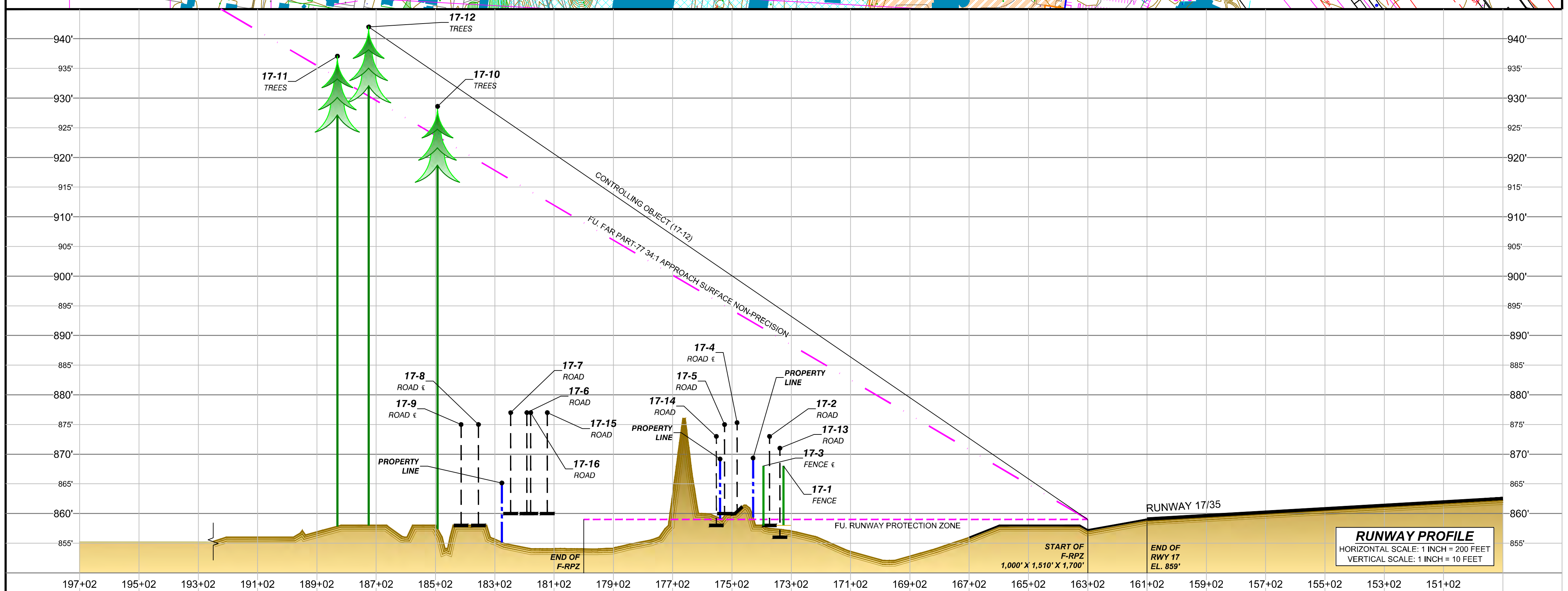
Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - (FAX) 517.321.5932

STATE ID. NO.	M&H PROJECT NO. — 11139-00-09004	DESIGNED	SADW	06/01/11
39-02	FEDERAL CONTRACT NO. — --	DRAWN	AEF	06/01/11
	STATE CONTRACT NO. — 3-26-0052-3409	CHECKED	SADW	10/07/11

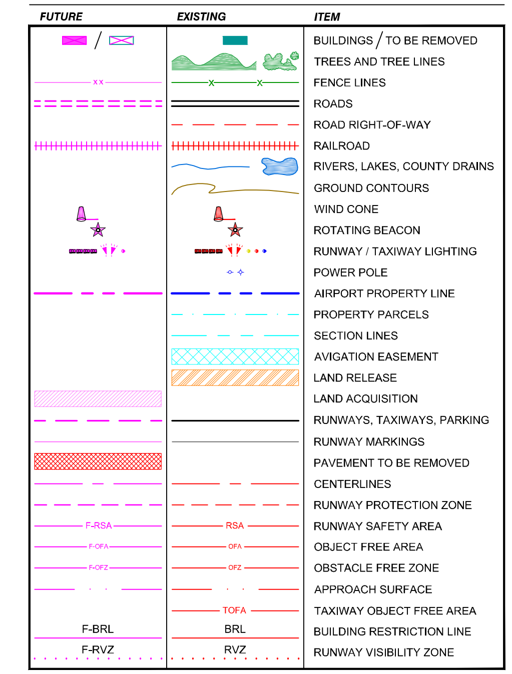
March 28, 2013 - 10 Ex Runway 17 Approach Plan.dwg

IF PAPER SIZE IS 24"x36" USE SCALE SHOWN. ALL OTHER PAPER SIZES ARE NOT TO SCALE.





LEGEND



SCALE:

1 INCH = 200 FEET

0 100 200 400

MAGNETIC DECLINATION:

5° 19' W, 0° 4' W
PER YEAR AS OF 02/09/2011

OBSTRUCTION TABLE

NO.	DESCRIPTION	TOP EL.	ALLOWABLE EL.	PENETRATION	DISPOSITION	SURFACE IMPACTED
17-1	FENCE	868'	889'	-21'	REMAIN	RPZ, AS
17-2	ROAD	873'	891'	-18'	REMAIN	RPZ, AS
17-3	FENCE	868'	891'	-23'	REMAIN	RPZ, AS
17-4	ROAD	875'	894'	-19'	REMAIN	RPZ, AS
17-5	ROAD	875'	895'	-20'	REMAIN	RPZ, AS
17-6	ROAD	877'	915'	-38'	REMAIN	AS
17-7	ROAD	877'	916'	-39'	REMAIN	AS
17-8	ROAD	875'	919'	-44'	REMAIN	AS
17-9	ROAD	875'	921'	-46'	REMAIN	AS
17-10	TREE	929'	924'	5'	REMOVE	AS
17-11	TREE	937'	933'	4'	REMOVE	AS
17-12	TREES	842'	830'	12'	REMOVE	AS
17-13	ROAD	871'	889'	-18'	REMAIN	RPZ, AS
17-14	ROAD	873'	896'	-23'	REMAIN	RPZ, AS
17-15	ROAD	877'	914'	-37'	REMAIN	AS
17-16	ROAD	877'	915'	-38'	REMAIN	AS

NOTES:

1. THE "TOP EL." AND "ALLOWABLE EL." ELEVATIONS ARE SHOWN AT "MEAN SEA LEVEL" (MSL).
2. THE "PENETRATION" ELEVATIONS ARE SHOWN AT "ABOVE GROUND LEVEL" (AGL).
3. THE TOP ELEVATION FOR ROADS INCLUDES THE FAR PART-77 15' CLEARANCE OVER ROADS REQUIREMENT.
4. THE TOP ELEVATION FOR ROADS INCLUDES THE FAR PART-77 17' CLEARANCE OVER INTERSTATE HIGHWAYS REQUIREMENT.

GENERAL NOTES:

1. BASE DATA AND OBSTRUCTION SURVEY PROVIDED BY WOOLPERT, LLP. (JUNE 2010)
2. OBJECTS IN THE TRANSITIONAL SURFACE DESIGNATED BY THE SYMBOL "( )TS".
3. OBSTRUCTION MITIGATION IN THE TRANSITIONAL SURFACE NOT OWNED BY THE AIRPORT SHOULD BE CLEARED AS FUNDS BECOME AVAILABLE.
4. FINAL DISPOSITION OF TREES TO BE "MITIGATED" WILL BE DETERMINED AT TIME OF CONSTRUCTION. FINAL DISPOSITION (PRUNING OR REMOVAL) WILL BE BASED UPON ACTUAL HEIGHT OF TREES AND PREFERENCE OF OWNER.
5. ORDER OF IMPORTANCE FOR LOCATION OF THE OBSTRUCTION:
   1. RUNWAY AREA
   2. PRIMARY SURFACE (PS)
   3. OBJECT FREE AREA (OFA) / RUNWAY SAFETY AREA (RSA)
   4. RUNWAY PROTECTION ZONE (RPZ)
   5. APPROACH SLOPE (AS)
   6. TRANSITIONAL SURFACE (TS)

"OBSTRUCTION TABLE" LEGEND

NO.	OBJECT LABEL ON APPROACH SHEET
DESCRIPTION	TYPE OF OBJECT - (EX. ROAD, TREES, BUILDINGS)
TOP ELEVATION	HIGHEST POINT OF OBJECT
ALLOWABLE ELEVATION	ELEVATION ALLOWED BY THE RUNWAY SURFACE - (EX. RPZ, AS, TS)
PENETRATION	TOTAL AMOUNT OF OBJECT LOCATED WITHIN APPROACH SURFACE
DISPOSITION	THE DETERMINATION OF WHAT ACTION TO TAKE WITH REFERENCE TO THE OBJECT
SURFACE IMPACTED	THE OBJECTS LOCATION RELATIVE TO THE FAR PART-77 APPROACH SURFACES SURROUNDING THE RUNWAY

"DISPOSITION" LEGEND

REMAIN	THE OBJECT IS LOCATED WITHIN A RUNWAY SURFACE; HOWEVER, IT DOES NOT PENETRATE THE APPROACH SURFACE.
REMOVE	THE OBJECT IS CONSIDERED AN OBSTRUCTION AND SHOULD BE COMPLETELY REMOVED.
PRUNE	THE OBJECT IS A TREE WHICH NEEDS TO BE PRUNED IN ORDER TO MAINTAIN HEIGHT CLEARANCE DUE TO MINIMAL IMPACT INTO THE FAR PART-77 APPROACH SURFACE.

"SURFACE" LEGEND

RPZ	RUNWAY PROTECTION ZONE
AS	APPROACH SURFACE
TS	TRANSITIONAL SURFACE

REVISIONS

NO.	DATE	REMARKS	BY	CHK
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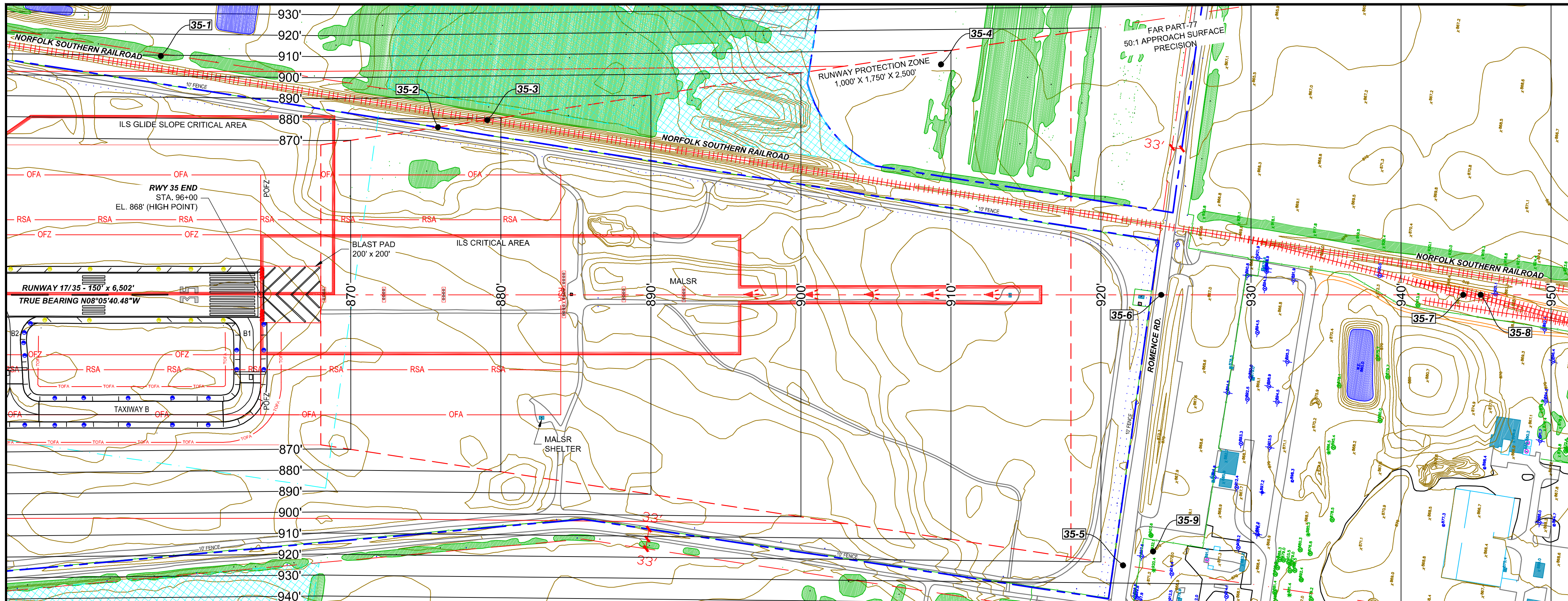
KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

AIRPORT LAYOUT PLAN
FUTURE RUNWAY 17 APPROACH PLAN

Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - (FAX) 517.321.5932

STATE ID. NO.	M&H PROJECT NO. — 11139-00-09004	DESIGNED	SADW	06/01/11
39-02	FEDERAL CONTRACT NO. — --	DRAWN	AEF	06/01/11
	STATE CONTRACT NO. — 3-26-0052-3409	CHECKED	SADW	10/07/11



LEGEND

EXISTING	ITEM
	BUILDINGS
	TREES AND TREE LINES
	FENCE LINES
	ROADS
	ROAD RIGHT-OF-WAY
	RAILROAD
	RIVERS, LAKES, COUNTY DRAINS
	GROUND CONTOURS
	ROTATING BEACON
	RUNWAY / TAXIWAY LIGHTING
	POWER POLE
	AIRPORT PROPERTY LINE
	PROPERTY PARCELS
	SECTION LINES
	AVIGATION EASEMENT
	RUNWAYS, TAXIWAYS, PARKING
	RUNWAY MARKINGS
	CENTERLINES
	RUNWAY PROTECTION ZONE
RSA	RUNWAY SAFETY AREA
OFA	OBJECT FREE AREA
OFZ	OBSTACLE FREE ZONE
	APPROACH SURFACE
TOFA	TAXIWAY OBJECT FREE AREA
BRL	BUILDING RESTRICTION LINE
RVZ	RUNWAY VISIBILITY ZONE

SCALE:

1 INCH = 200 FEET

0 100 200 400

MAGNETIC DECLINATION:

5° 19' W, 0° 4' W

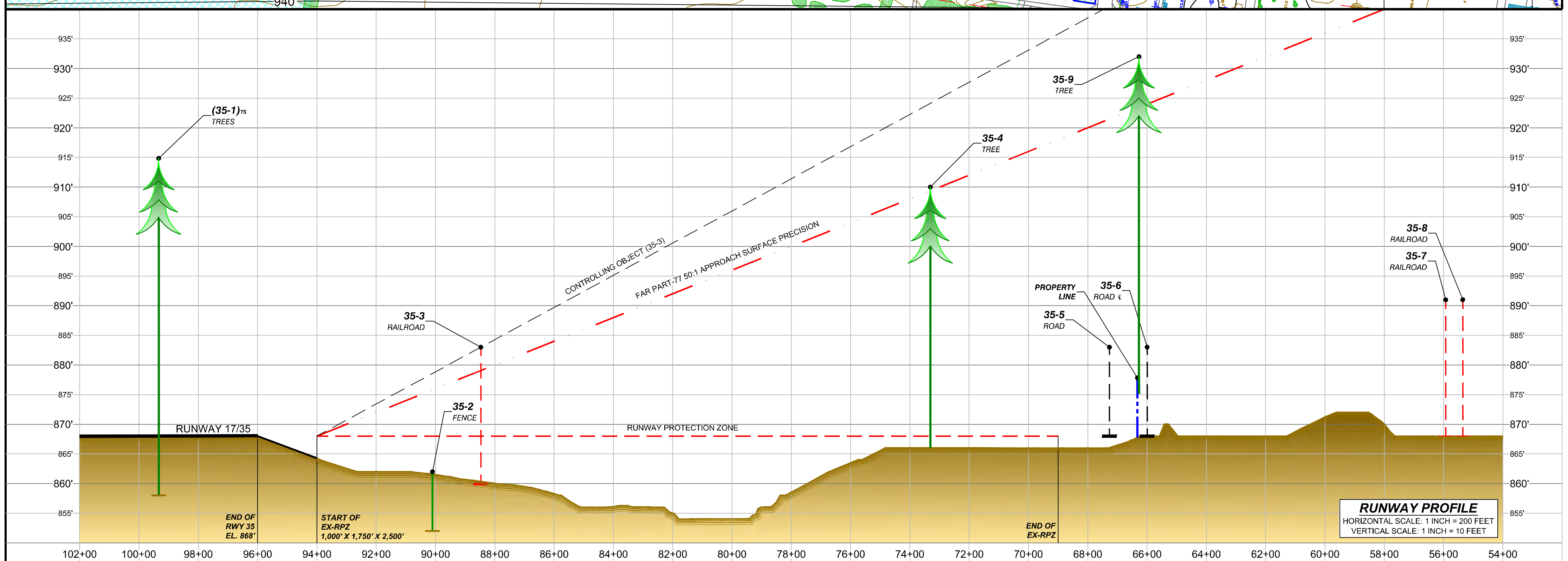
PER YEAR AS OF 02/09/2011

OBSTRUCTION TABLE

NO.	DESCRIPTION	TOP EL.	ALLOWABLE EL.	PENETRATION	DISPOSITION	SURFACE IMPACTED
35-1	TREES	915'	912'	3'	MITIGATE	TS
35-2	FENCE	862'	876'	-14'	REMAIN	RPZ, AS
35-3	RAILROAD(4)	883'	879'	4'	RELOCATE	RPZ, AS
35-4	TREE	910'	909'	1'	MITIGATE	RPZ, AS
35-5	ROAD(3)	883'	921'	-38'	REMAIN	AS
35-6	ROAD(3)	883'	924'	-41'	REMAIN	AS
35-7	RAILROAD(4)	891'	944'	-53'	REMAIN	AS
35-9	RAILROAD(4)	891'	945'	-54'	REMAIN	AS
35-10	TREE	932'	923'	9'	REMOVE	AS

NOTES:

1. THE "TOP EL." AND "ALLOWABLE EL." ELEVATIONS ARE SHOWN AT "MEAN SEA LEVEL" (MSL).
2. THE "PENETRATION" ELEVATIONS ARE SHOWN AT "ABOVE GROUND LEVEL" (AGL).
3. THE TOP ELEVATION FOR "ROAD" INCLUDES THE FAR PART-77 15' CLEARANCE OVER ROADS REQUIREMENT.
4. THE TOP ELEVATION FOR "RAILROAD" INCLUDES THE FAR PART-77 23' CLEARANCE OVER RAILROADS REQUIREMENT.



RUNWAY PROFILE

HORIZONTAL SCALE: 1 INCH = 200 FEET

VERTICAL SCALE: 1 INCH = 10 FEET

GENERAL NOTES:

1. BASE DATA AND OBSTRUCTION SURVEY PROVIDED BY WOOLPERT, LLP. (JUNE 2010)
2. OBJECTS IN THE TRANSITIONAL SURFACE DESIGNATED BY THE SYMBOL "( )TS".
3. OBSTRUCTION MITIGATION IN THE TRANSITIONAL SURFACE NOT OWNED BY THE AIRPORT SHOULD BE CLEARED AS FUNDS BECOME AVAILABLE.
4. FINAL DISPOSITION OF TREES TO BE "MITIGATED" WILL BE DETERMINED AT TIME OF CONSTRUCTION. FINAL DISPOSITION (PRUNING OR REMOVAL) WILL BE BASED UPON ACTUAL HEIGHT OF TREES AND PREFERENCE OF OWNER.
5. ORDER OF IMPORTANCE FOR LOCATION OF THE OBSTRUCTION:
   1. RUNWAY AREA
   2. PRIMARY SURFACE (PS)
   3. OBJECT FREE AREA (OFA) / RUNWAY SAFETY AREA (RSA)
   4. RUNWAY PROTECTION ZONE (RPZ)
   5. APPROACH SLOPE (AS)
   6. TRANSITIONAL SURFACE (TS)

"OBSTRUCTION TABLE" LEGEND

NO.	OBJECT LABEL ON APPROACH SHEET
DESCRIPTION	TYPE OF OBJECT - (EX. ROAD, TREES, BUILDINGS)
TOP ELEVATION	HIGHEST POINT OF OBJECT
ALLOWABLE ELEVATION	ELEVATION ALLOWED BY THE RUNWAY SURFACE - (EX. RPZ, AS, TS)
PENETRATION	TOTAL AMOUNT OF OBJECT LOCATED WITHIN APPROACH SURFACE
DISPOSITION	THE DETERMINATION OF WHAT ACTION TO TAKE WITH REFERENCE TO THE OBJECT
SURFACE IMPACTED	THE OBJECTS LOCATION RELATIVE TO THE FAR PART-77 APPROACH SURFACES SURROUNDING THE RUNWAY

"DISPOSITION" LEGEND

REMAIN	THE OBJECT IS LOCATED WITHIN A RUNWAY SURFACE; HOWEVER, IT DOES NOT PENETRATE THE APPROACH SURFACE.
REMOVE	THE OBJECT IS CONSIDERED AN OBSTRUCTION AND SHOULD BE COMPLETELY REMOVED.
PRUNE	THE OBJECT IS A TREE WHICH NEEDS TO BE PRUNED IN ORDER TO MAINTAIN HEIGHT CLEARANCE DUE TO MINIMAL IMPACT INTO THE FAR PART-77 APPROACH SURFACE.
DONH	THE OBJECT IS A STATIONARY PENETRATION THAT SHOULD BE ANALYZED FOR A DETERMINATION OF NON HAZARD.

"SURFACE" LEGEND

RPZ	RUNWAY PROTECTION ZONE
AS	APPROACH SURFACE
TS	TRANSITIONAL SURFACE

REVISIONS

NO.	DATE	REMARKS	BY	CHK
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KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT

KALAMAZOO, MICHIGAN

AIRPORT LAYOUT PLAN

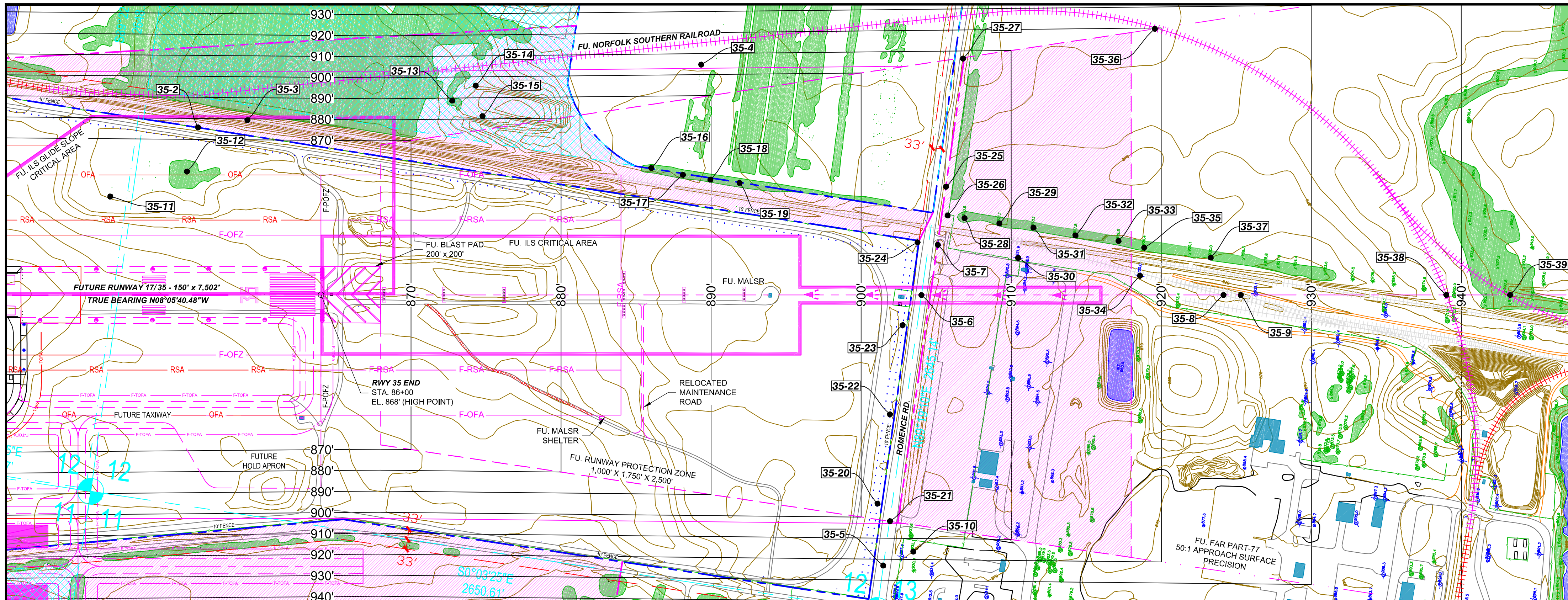
EXISTING RUNWAY 35 APPROACH

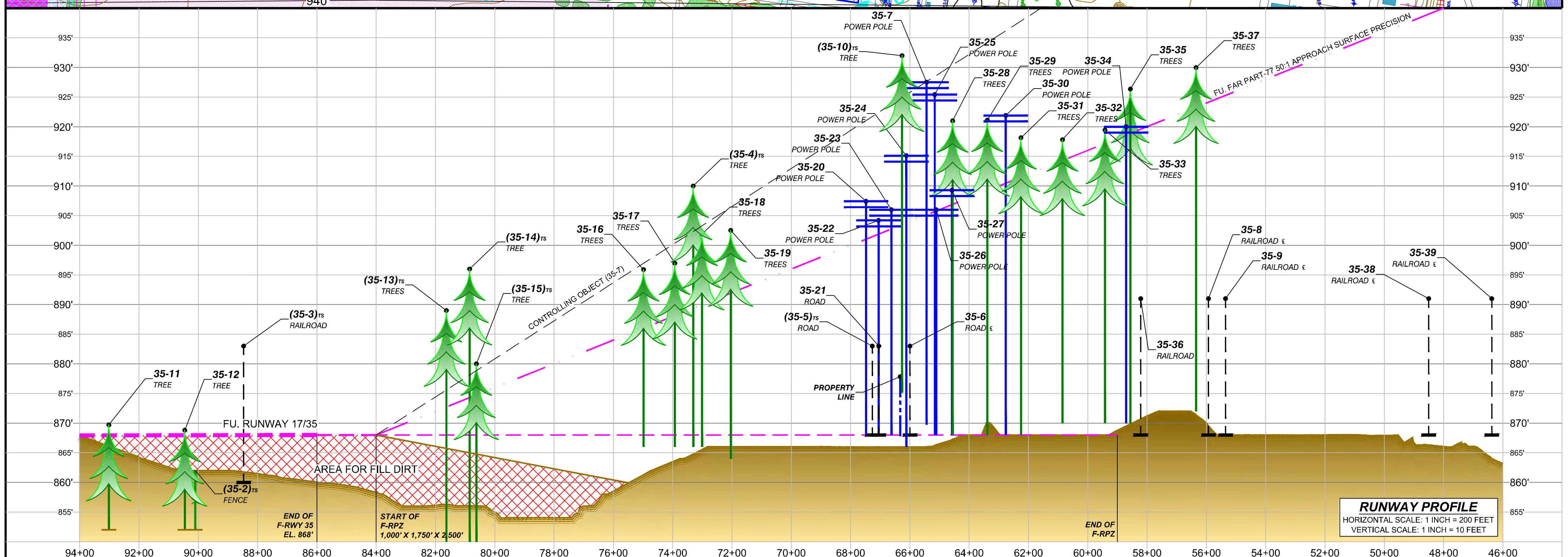
Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - 517.321.5932 FAX

STATE ID. NO.	M&H PROJECT NO. —	11139-00-09004	DESIGNED	SADW	06/01/11
39-02	FEDERAL CONTRACT NO. —	---	DRAWN	AEF	06/01/11
	STATE CONTRACT NO. —	3-26-0052-3409	CHECKED	SADW	10/07/11

March 28, 2013 - 12 Ex Runway 35 Approach Plan.dwg

IF PAPER SIZE IS 24"x36" USE SCALE SHOWN. ALL OTHER PAPER SIZES ARE NOT TO SCALE.





RUNWAY PROFILE
HORIZONTAL SCALE: 1 INCH = 200 FEET
VERTICAL SCALE: 1 INCH = 10 FEET

LEGEND

FUTURE	EXISTING	ITEM
		BUILDINGS / TO BE REMOVED
		TREES AND TREE LINES
		FENCE LINES
		ROADS
		ROAD RIGHT-OF-WAY
		RAILROAD
		RIVERS, LAKES, COUNTY DRAINS
		GROUND CONTOURS
		RUNWAY / TAXIWAY LIGHTING
		POWER POLE
		AIRPORT PROPERTY LINE
		PROPERTY PARCELS
		SECTION LINES
		AVIGATION EASEMENT
		LAND ACQUISITION
		RUNWAYS, TAXIWAYS, PARKING
		RUNWAY MARKINGS
		CENTERLINES
		RUNWAY PROTECTION ZONE
F-RSA	RSA	RUNWAY SAFETY AREA
F-OFA	OFA	OBJECT FREE AREA
F-OFZ	OFZ	OBSTACLE FREE ZONE
		APPROACH SURFACE
F-TOFA		TAXIWAY OBJECT FREE AREA
F-BRL	BRL	BUILDING RESTRICTION LINE
F-RVZ	RVZ	RUNWAY VISIBILITY ZONE

SCALE:
1 INCH = 200 FEET
0 100 200 400

MAGNETIC DECLINATION

MAGNETIC DECLINATION:
5° 19' W, 0° 4' W
PER YEAR AS OF 02/09/2011

OBSTRUCTION TABLE

NO.	DESCRIPTION	TOP EL.	ALLOWABLE EL.	PENETRATION	DISPOSITION	SURFACE IMPACTED
35-1	TREES	915'	912'	3'	MITIGATE	TS
35-2	FENCE	862'	876'	-14'	REMAIN	TS
35-3	RAILROAD(4)	883'	879'	4'	RELOCATE	TS
35-4	TREE	910'	903'	7'	MITIGATE	TS
35-5	ROAD(3)	883'	921'	-38'	REMAIN	TS
35-6	ROAD(3)	883'	904'	-21'	REMAIN	RPZ, AS
35-7	POWER POLE	928'	905'	23'	LOWER	RPZ, AS
35-8	RAILROAD(4)	891'	924'	-33'	RELOCATE	AS
35-9	RAILROAD(4)	891'	925'	-34'	RELOCATE	AS
35-10	TREE	932'	916'	16'	REMOVE	TS
35-11	TREE	870'	868'	2'	REMOVE	PS
35-12	TREE	869'	868'	1'	REMOVE	PS
35-13	TREES	889'	887'	2'	MITIGATE	TS
35-14	TREES	896'	894'	2'	MITIGATE	TS
35-15	TREES	879'	880'	-1'	MITIGATE	TS
35-16	TREES	896'	886'	10'	REMOVE	RPZ, AS
35-17	TREES	897'	888'	9'	REMOVE	RPZ, AS
35-18	TREES	902'	890'	12'	REMOVE	RPZ, AS
35-19	TREES	903'	892'	11'	REMOVE	RPZ, AS
35-20	POWER POLE	907'	901'	6'	LOWER	RPZ, AS
35-21	ROAD	883'	902'	-19'	REMAIN	RPZ, AS
35-22	POWER POLE	904'	902'	2'	LOWER	RPZ, AS
35-23	POWER POLE	906'	903'	3'	LOWER	RPZ, AS
35-24	POWER POLE	915'	904'	11'	LOWER	RPZ, AS
35-25	POWER POLE	925'	906'	19'	LOWER	RPZ, AS
35-26	POWER POLE	906'	906'	0'	LOWER	RPZ, AS
35-27	POWER POLE	909'	907'	2'	LOWER	RPZ, AS
35-28	TREES	921'	907'	14'	REMOVE	RPZ, AS
35-29	TREES	921'	909'	12'	REMOVE	RPZ, AS
35-30	POWER POLE	922'	910'	12'	LOWER	RPZ, AS
35-31	TREES	918'	911'	7'	REMOVE	RPZ, AS
35-32	TREES	918'	914'	4'	REMOVE	RPZ, AS
35-33	TREES	919'	917'	2'	REMOVE	RPZ, AS
35-34	POWER POLE	920'	919'	1'	LOWER	AS
35-35	TREES	926'	919'	7'	REMOVE	AS
35-36	RAILROAD(4)	891'	919'	-28'	REMAIN	AS
35-37	TREES	930'	923'	7'	REMOVE	AS
35-38	RAILROAD(4)	891'	924'	-33'	REMAIN	AS
35-39	RAILROAD(4)	891'	925'	-34'	REMAIN	AS

NOTES:
1. THE "TOP EL." AND "ALLOWABLE EL." ELEVATIONS ARE SHOWN AT "MEAN SEA LEVEL" (MSL).
2. THE "PENETRATION" ELEVATIONS ARE SHOWN AT "ABOVE GROUND LEVEL" (AGL).
3. THE TOP ELEVATION FOR "ROAD" INCLUDES THE FAR PART-77 15' CLEARANCE OVER ROADS REQUIREMENT.
4. THE TOP ELEVATION FOR "RAILROAD" INCLUDES THE FAR PART-77 23' CLEARANCE OVER RAILROADS REQUIREMENT.

GENERAL NOTES:

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   3. OBJECT FREE AREA (OFA) / RUNWAY SAFETY AREA (RSA)
   4. RUNWAY PROTECTION ZONE (RPZ)
   5. APPROACH SLOPE (AS)
   6. TRANSITIONAL SURFACE (TS)

"OBSTRUCTION TABLE" LEGEND

NO.	OBJECT LABEL ON APPROACH SHEET
DESCRIPTION	TYPE OF OBJECT - (EX. ROAD, TREES, BUILDINGS)
TOP ELEVATION	HIGHEST POINT OF OBJECT
ALLOWABLE ELEVATION	ELEVATION ALLOWED BY THE RUNWAY SURFACE - (EX. RPZ, AS, TS)
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DISPOSITION	THE DETERMINATION OF WHAT ACTION TO TAKE WITH REFERENCE TO THE OBJECT
SURFACE IMPACTED	THE OBJECTS LOCATION RELATIVE TO THE FAR PART-77 APPROACH SURFACES SURROUNDING THE RUNWAY

"DISPOSITION" LEGEND

REMAIN	THE OBJECT IS LOCATED WITHIN A RUNWAY SURFACE; HOWEVER, IT DOES NOT PENETRATE THE APPROACH SURFACE.
REMOVE	THE OBJECT IS CONSIDERED AN OBSTRUCTION AND SHOULD BE COMPLETELY REMOVED.
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"SURFACE" LEGEND

RPZ	RUNWAY PROTECTION ZONE
AS	APPROACH SURFACE
TS	TRANSITIONAL SURFACE

REVISIONS

NO.	DATE	REMARKS	BY	CHK
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KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

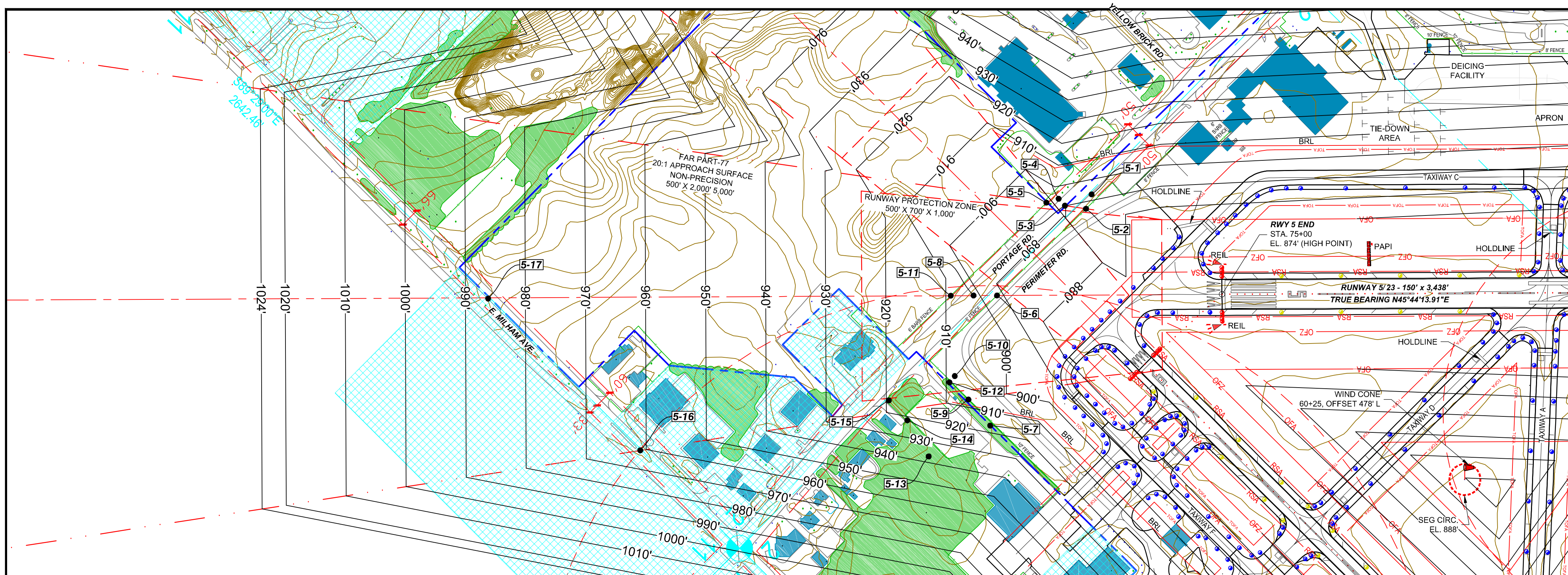
AIRPORT LAYOUT PLAN
FUTURE RUNWAY 35 APPROACH

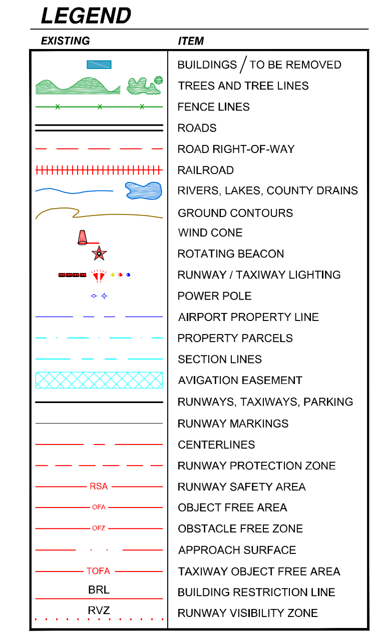
Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - 517.321.5932 FAX

STATE ID. NO. 39-02	M&H PROJECT NO. — 11139-00-09004	DESIGNED	SADW	06/01/11
	FEDERAL CONTRACT NO. — ---	DRAWN	AEF	06/01/11
	STATE CONTRACT NO. — 3-26-0052-3409	CHECKED	SADW	10/07/11

March 28, 2013 - 13 F Runway 35 Approach Plan.dwg

IF PAPER SIZE IS 24"x36" USE SCALE SHOWN. ALL OTHER PAPER SIZES ARE NOT TO SCALE.





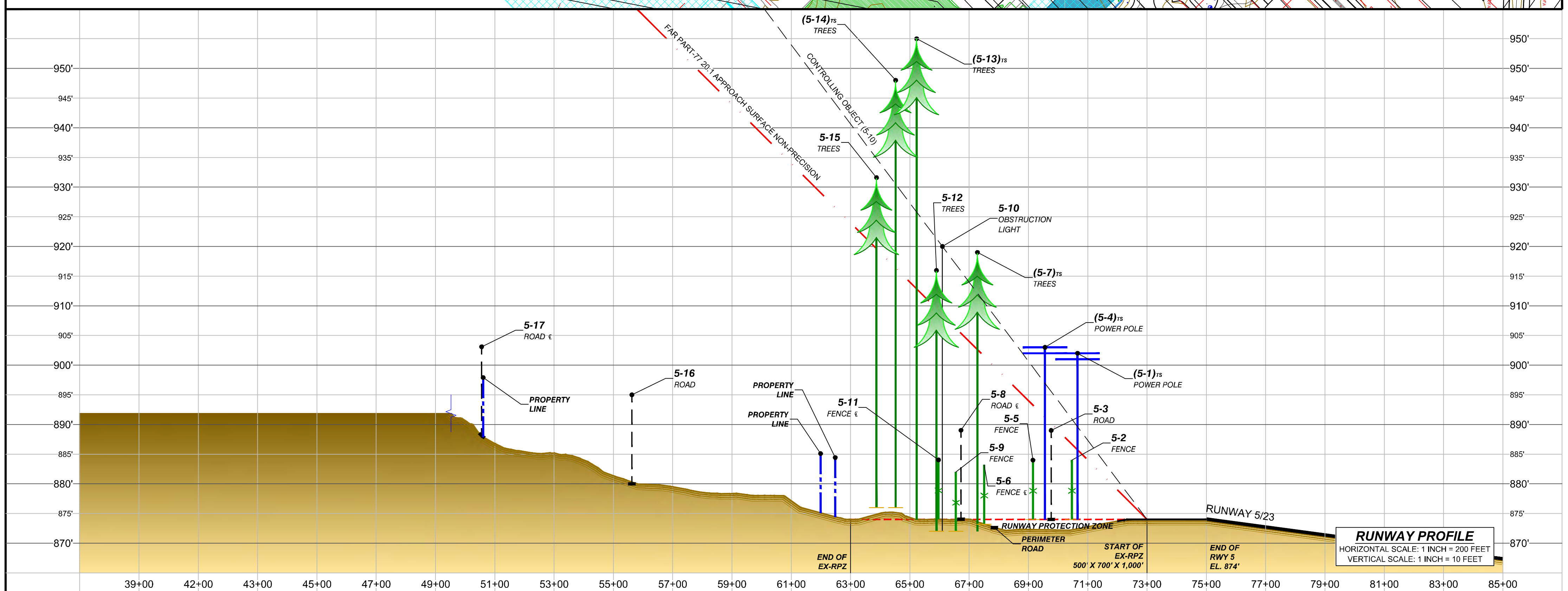
SCALE:

1 INCH = 200 FEET

0 100 200 400

MAGNETIC DECLINATION:

5° 19' W, 0° 4' W
PER YEAR AS OF 02/09/2011



OBSTRUCTION TABLE

NO.	DESCRIPTION	TOP EL.	ALLOWABLE EL.	PENETRATION	DISPOSITION	SURFACE IMPACTED
5-1	POWER POLE	902'	891'	11'	LOWER	TS
5-2	FENCE	884'	887'	-3'	REMAIN	AS
5-3	ROAD(3)	889'	890'	-1'	REMAIN	AS
5-4	POWER POLE	903'	892'	11'	LOWER	TS
5-5	FENCE	884'	893'	-9'	REMAIN	AS
5-6	FENCE	883'	901'	-18'	REMAIN	RPZ, AS
5-7	TREES	919'	917'	2'	MITIGATE	TS
5-8	ROAD(3)	889'	905'	-16'	REMAIN	RPZ, AS
5-9	FENCE	884'	906'	-22'	REMAIN	RPZ, AS
5-10	OBSTR. LIGHT	920'	909'	11'	REMOVE	RPZ, AS
5-11	FENCE	882'	909'	-27'	REMAIN	RPZ, AS
5-12	TREES	916'	910'	6'	MITIGATE	AS
5-13	TREES	955'	937'	18'	MITIGATE	TS
5-14	TREES	948'	920'	28'	MITIGATE	AS
5-15	TREES	932'	920'	12'	MITIGATE	AS
5-16	ROAD(3)	895'	961'	-66'	REMAIN	AS
5-17	ROAD(3)	903'	986'	-83'	REMAIN	AS

NOTES:

1. THE "TOP EL." AND "ALLOWABLE EL." ELEVATIONS ARE SHOWN AT "MEAN SEA LEVEL" (MSL).
2. THE "PENETRATION" ELEVATIONS ARE SHOWN AT "ABOVE GROUND LEVEL" (AGL).
3. THE TOP ELEVATION FOR ROADS INCLUDES THE FAR PART-77 15' CLEARANCE OVER ROADS REQUIREMENT.

GENERAL NOTES:

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   6. TRANSITIONAL SURFACE (TS)

"OBSTRUCTION TABLE" LEGEND

NO.	OBJECT LABEL ON APPROACH SHEET
DESCRIPTION	TYPE OF OBJECT - (EX. ROAD, TREES, BUILDINGS)
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"DISPOSITION" LEGEND

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"SURFACE" LEGEND

RPZ	RUNWAY PROTECTION ZONE
AS	APPROACH SURFACE
TS	TRANSITIONAL SURFACE

REVISIONS

NO.	DATE	REMARKS	BY	CHK
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KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

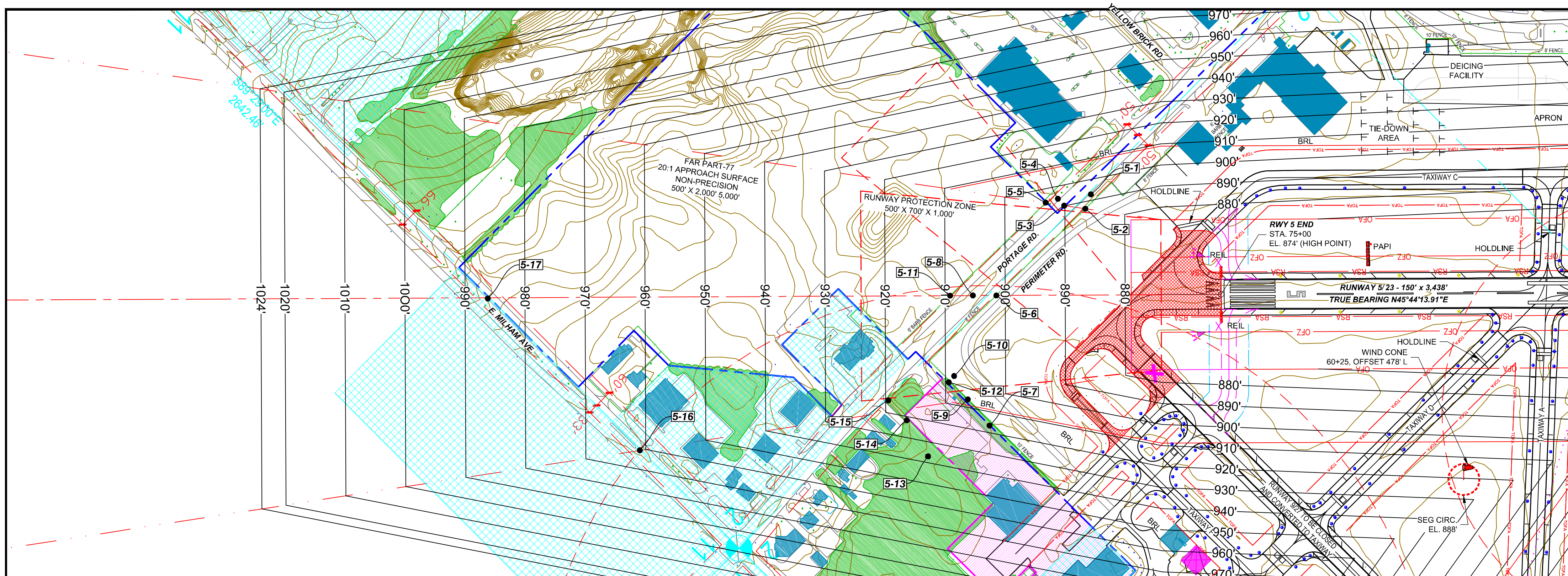
AIRPORT LAYOUT PLAN
EXISTING RUNWAY 5 APPROACH PLAN

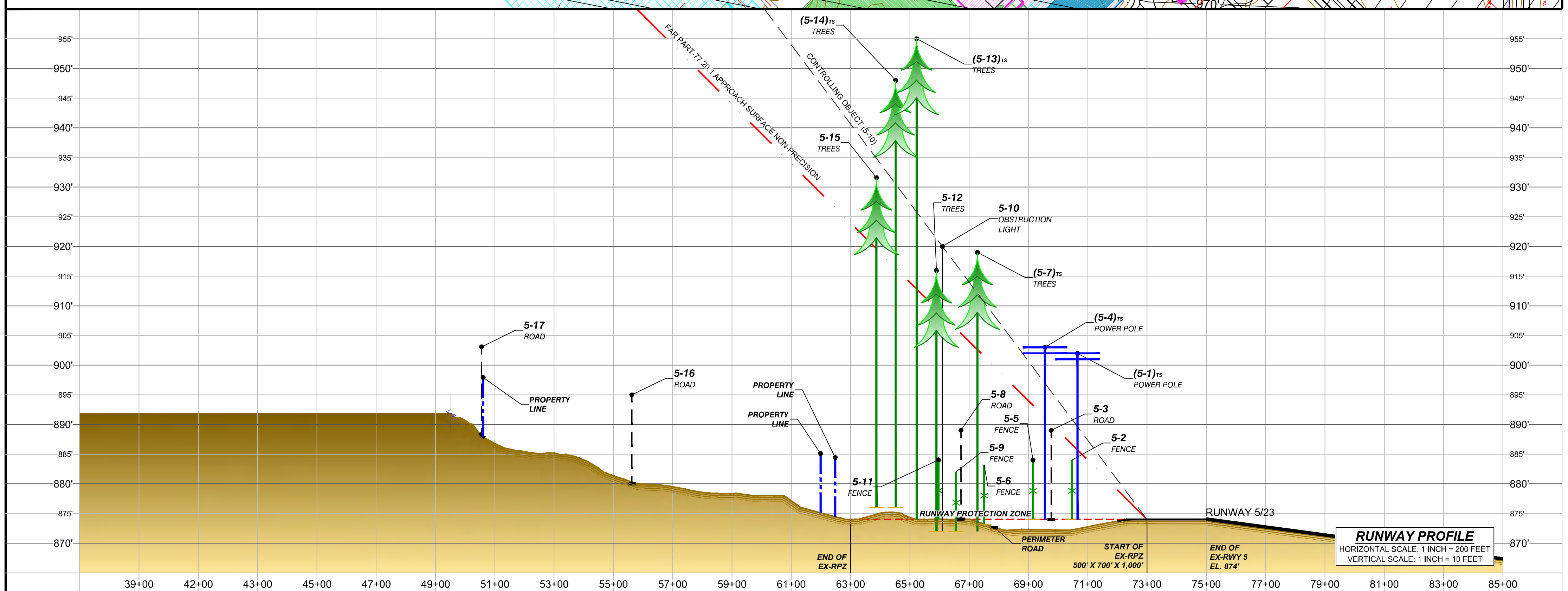
Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - 517.321.5932 FAX

STATE ID. NO.				
39-02	M&H PROJECT NO. — 11139-00-09004	DESIGNED	SADW	06/01/11
	FEDERAL CONTRACT NO. — --	DRAWN	AEF	06/01/11
	STATE CONTRACT NO. — 3-26-0052-3409	CHECKED	SADW	10/07/11

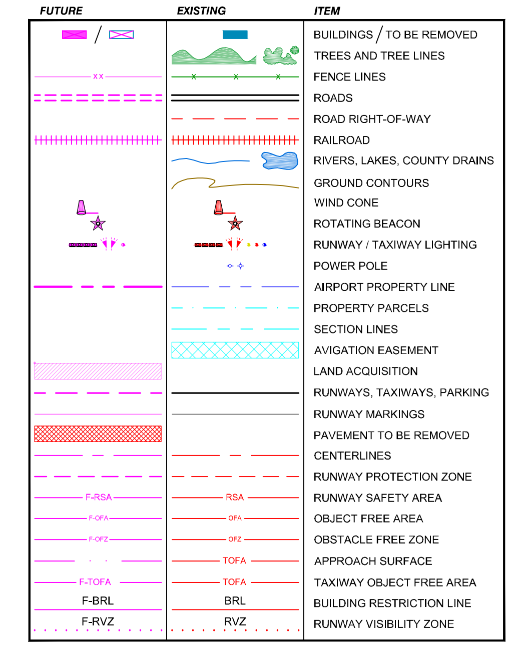
March 28, 2013 - 14 Ex Runway 5 Approach Plan.dwg

IF PAPER SIZE IS 24"x36" USE SCALE SHOWN. ALL OTHER PAPER SIZES ARE NOT TO SCALE.





LEGEND



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5° 19' W, 0° 4' W
PER YEAR AS OF 02/09/2011

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"SURFACE" LEGEND

RPZ	RUNWAY PROTECTION ZONE
AS	APPROACH SURFACE
TS	TRANSITIONAL SURFACE

REVISIONS

NO.	DATE	REMARKS	BY	CHK
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KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

AIRPORT LAYOUT PLAN
FUTURE RUNWAY 5 APPROACH PLAN

Mead & Hunt
2605 PORT LANSING ROAD
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517.321.8334 - 517.321.5932 FAX

STATE ID. NO.			
39-02	M&H PROJECT NO. — 11139-00-09004	DESIGNED SADW	06/01/11
	FEDERAL CONTRACT NO. — --	DRAWN AEF	06/01/11
	STATE CONTRACT NO. — 3-26-0052-3409	CHECKED SADW	10/07/11

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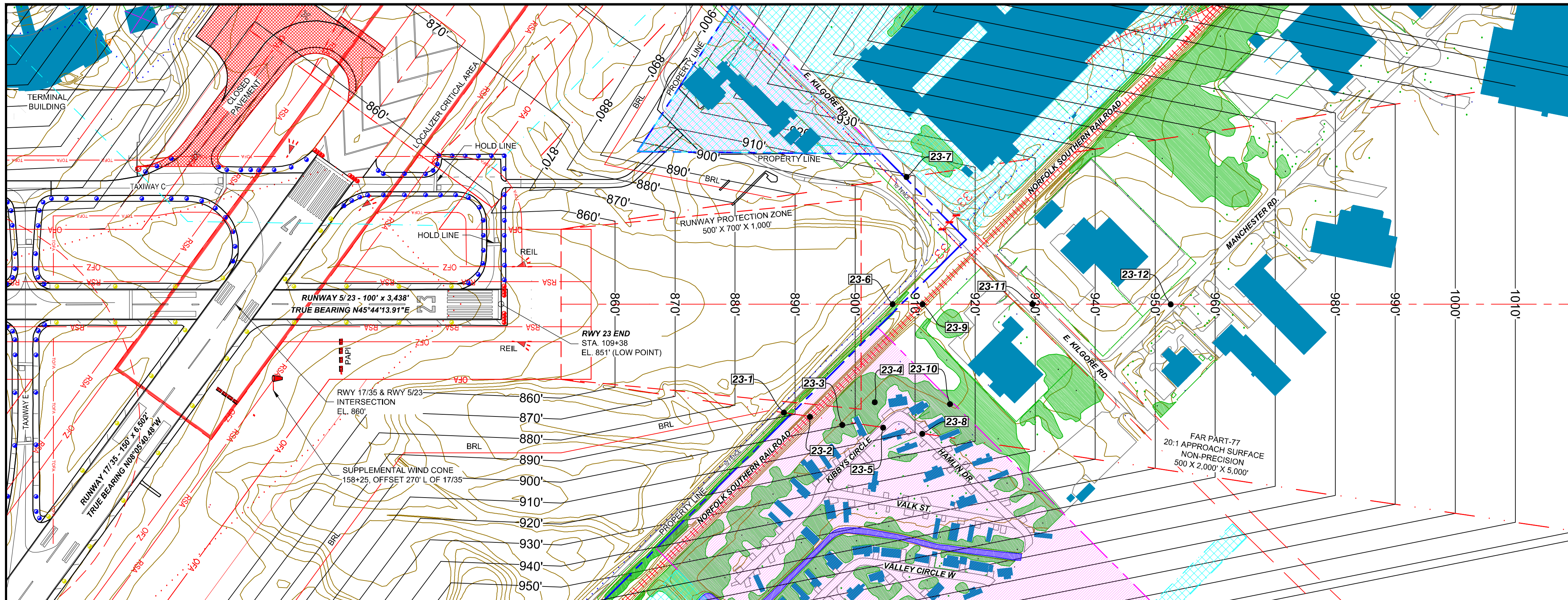
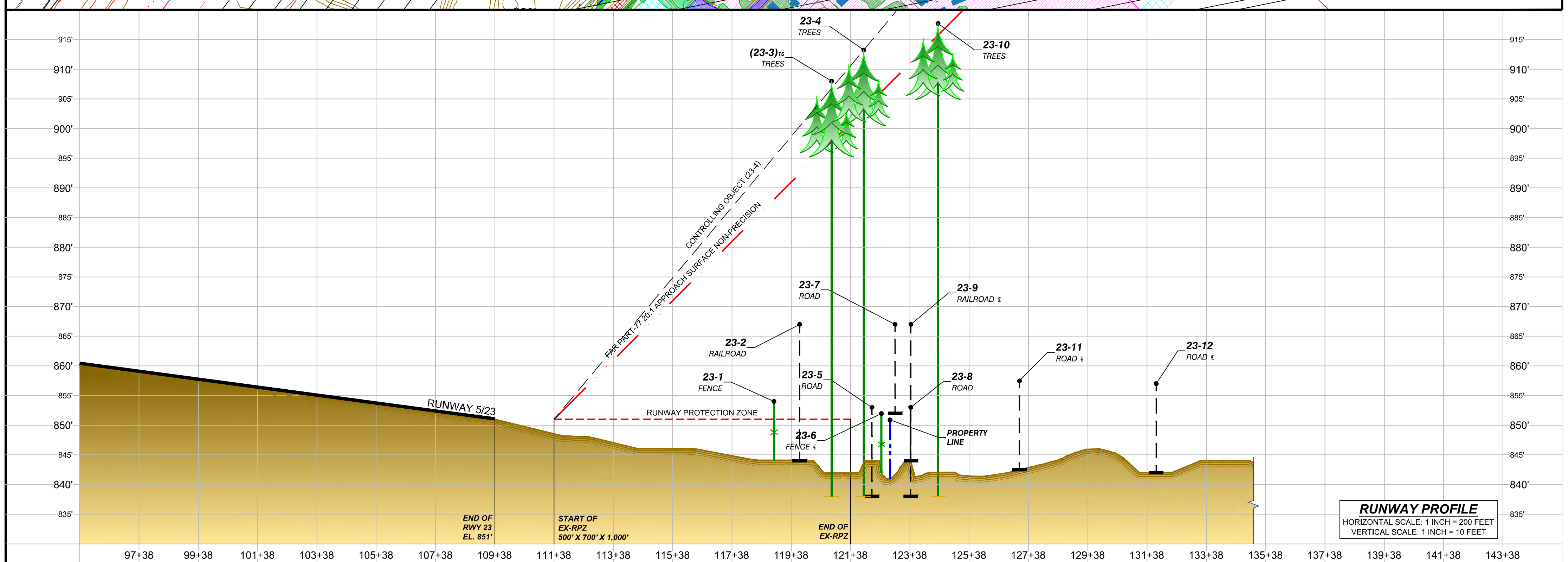


LEGEND

EXISTING	ITEM
	BUILDINGS / TO BE REMOVED
	TREES AND TREE LINES
	FENCE LINES
	ROADS
	ROAD RIGHT-OF-WAY
	RAILROAD
	RIVERS, LAKES, COUNTY DRAINS
	GROUND CONTOURS
	WIND CONE
	ROTATING BEACON
	RUNWAY / TAXIWAY LIGHTING
	POWER POLE
	AIRPORT PROPERTY LINE
	PROPERTY PARCELS
	SECTION LINES
	AVIGATION EASEMENT
	FUTURE LAND ACQUISITION
	RUNWAYS, TAXIWAYS, PARKING
	RUNWAY MARKINGS
	PAVEMENT TO BE REMOVED
	CENTERLINES
	RUNWAY PROTECTION ZONE
RSA	RUNWAY SAFETY AREA
OFA	OBJECT FREE AREA
OFZ	OBSTACLE FREE ZONE
	APPROACH SURFACE
TOFA	TAXIWAY APPROACH SLOPE
BRL	BUILDING RESTRICTION LINE
RVZ	RUNWAY VISIBILITY ZONE

SCALE:
1 INCH = 200 FEET
0 100 200 400

MAGNETIC DECLINATION:
5° 19' W, 0° 4' W
PER YEAR AS OF 02/09/2011



RUNWAY PROFILE
HORIZONTAL SCALE: 1 INCH = 200 FEET
VERTICAL SCALE: 1 INCH = 10 FEET

OBSTRUCTION TABLE

NO.	DESCRIPTION	TOP EL.	ALLOWABLE EL.	PENETRATION	DISPOSITION	SURFACE IMPACTED
23-1	FENCE	867'	892'	-25'	REMAIN	RPZ, AS
23-2	RAILROAD(4)	908'	899'	9'	REMAIN	RPZ, AS
23-3	TREES	913'	903'	10'	MITIGATE	TS
23-4	TREES	853'	905'	-52'	MITIGATE	AS
23-5	ROAD(3)	852'	906'	-54'	REMAIN	AS
23-6	FENCE	867'	909'	-42'	REMAIN	AS
23-7	ROAD(3)	853'	911'	-58'	REMAIN	AS
23-8	ROAD(3)	867'	911'	-44'	REMAIN	AS
23-9	RAILROAD(4)	918'	916'	2'	REMAIN	AS
23-10	TREES	857'	929'	-72'	MITIGATE	AS
23-11	ROAD(3)	857'	953'	-96'	REMAIN	AS
23-12	ROAD(3)				REMAIN	AS

NOTES:
1. THE "TOP EL." AND "ALLOWABLE EL." ELEVATIONS ARE SHOWN AT "MEAN SEA LEVEL" (MSL).
2. THE "PENETRATION" ELEVATIONS ARE SHOWN AT "ABOVE GROUND LEVEL" (AGL).
3. THE TOP ELEVATION FOR "ROAD" INCLUDES THE FAR PART-77 15' CLEARANCE OVER ROADS REQUIREMENT.
4. THE TOP ELEVATION FOR "RAILROAD" INCLUDES THE FAR PART-77 23' CLEARANCE OVER RAILROADS REQUIREMENT.

GENERAL NOTES:

1. BASE DATA AND OBSTRUCTION SURVEY PROVIDED BY WOOLPERT, LLP. (JUNE 2010)
2. OBJECTS IN THE TRANSITIONAL SURFACE DESIGNATED BY THE SYMBOL "( )TS".
3. OBSTRUCTION MITIGATION IN THE TRANSITIONAL SURFACE NOT OWNED BY THE AIRPORT SHOULD BE CLEARED AS FUNDS BECOME AVAILABLE.
4. FINAL DISPOSITION OF TREES TO BE "MITIGATED" WILL BE DETERMINED AT TIME OF CONSTRUCTION. FINAL DISPOSITION (PRUNING OR REMOVAL) WILL BE BASED UPON ACTUAL HEIGHT OF TREES AND PREFERENCE OF OWNER.
5. ORDER OF IMPORTANCE FOR LOCATION OF THE OBSTRUCTION:
   1. RUNWAY AREA
   2. PRIMARY SURFACE (PS)
   3. OBJECT FREE AREA (OFA) / RUNWAY SAFETY AREA (RSA)
   4. RUNWAY PROTECTION ZONE (RPZ)
   5. APPROACH SLOPE (AS)
   6. TRANSITIONAL SURFACE (TS)

"OBSTRUCTION TABLE" LEGEND

NO.	OBJECT LABEL ON APPROACH SHEET
DESCRIPTION	TYPE OF OBJECT - (EX. ROAD, TREES, BUILDINGS)
TOP ELEVATION	HIGHEST POINT OF OBJECT
ALLOWABLE ELEVATION	ELEVATION ALLOWED BY THE RUNWAY SURFACE - (EX. RPZ, AS, TS)
PENETRATION	TOTAL AMOUNT OF OBJECT LOCATED WITHIN APPROACH SURFACE
DISPOSITION	THE DETERMINATION OF WHAT ACTION TO TAKE WITH REFERENCE TO THE OBJECT
SURFACE IMPACTED	THE OBJECTS LOCATION RELATIVE TO THE FAR PART-77 APPROACH SURFACES SURROUNDING THE RUNWAY

"DISPOSITION" LEGEND

REMAIN	THE OBJECT IS LOCATED WITHIN A RUNWAY SURFACE; HOWEVER, IT DOES NOT PENETRATE THE APPROACH SURFACE.
REMOVE	THE OBJECT IS CONSIDERED AN OBSTRUCTION AND SHOULD BE COMPLETELY REMOVED.
PRUNE	THE OBJECT IS A TREE WHICH NEEDS TO BE PRUNED IN ORDER TO MAINTAIN HEIGHT CLEARANCE DUE TO MINIMAL IMPACT INTO THE FAR PART-77 APPROACH SURFACE.

"SURFACE" LEGEND

RPZ	RUNWAY PROTECTION ZONE
AS	APPROACH SURFACE
TS	TRANSITIONAL SURFACE

REVISIONS

NO.	DATE	REMARKS	BY	CHK
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KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

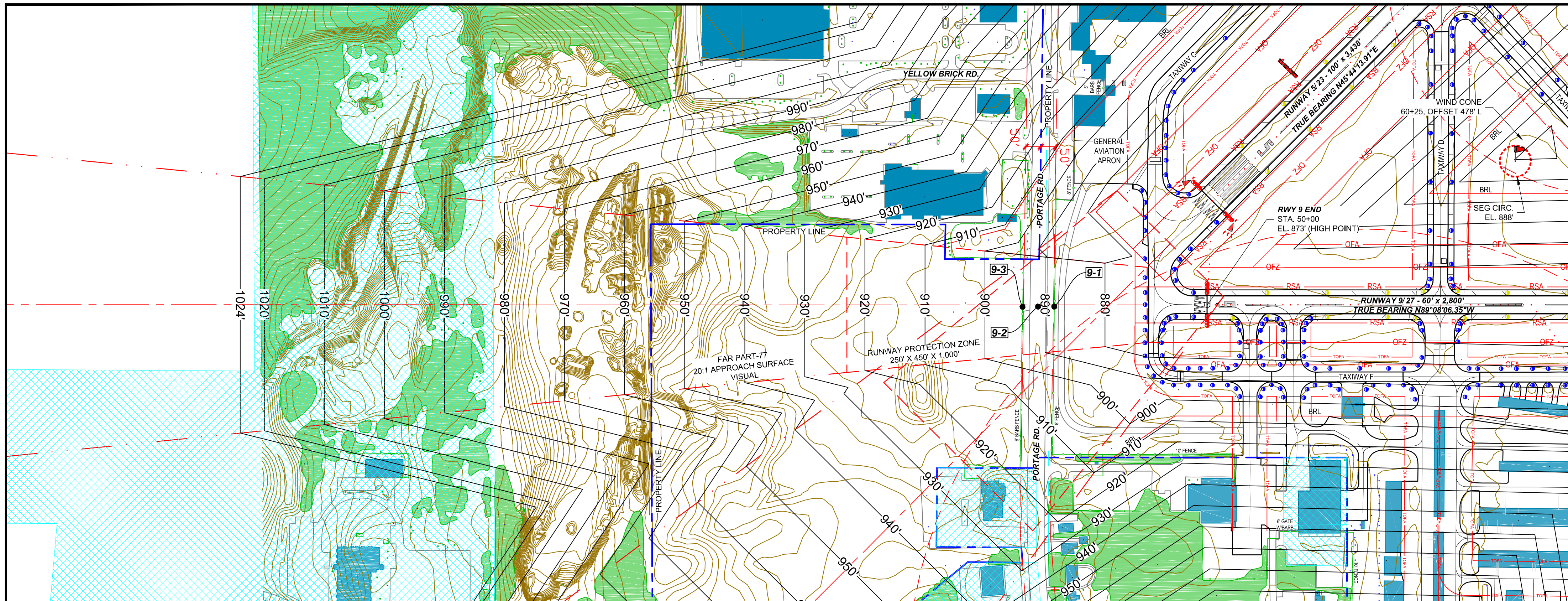
AIRPORT LAYOUT PLAN
EXISTING AND FUTURE RUNWAY 23 APPROACH

Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - 517.321.5932 FAX

STATE ID. NO.	M&H PROJECT NO.	11139-00-09004	DESIGNED	SADW	06/01/11
39-02	FEDERAL CONTRACT NO. —	--	DRAWN	AEF	06/01/11
	STATE CONTRACT NO. —	3-26-0052-3409	CHECKED	SADW	10/07/11

February 19, 2013 - 16 Ex-F Runway 23 Approach Plan.dwg

IF PAPER SIZE IS 24"x36" USE SCALE SHOWN. ALL OTHER PAPER SIZES ARE NOT TO SCALE.



LEGEND

EXISTING	ITEM
	BUILDINGS
	TREES AND TREE LINES
	FENCE LINES
	ROADS
	ROAD RIGHT-OF-WAY
	RAILROAD
	RIVERS, LAKES, COUNTY DRAINS
	GROUND CONTOURS
	WIND CONE
	ROTATING BEACON
	RUNWAY / TAXIWAY LIGHTING
	POWER POLE
	AIRPORT PROPERTY LINE
	PROPERTY PARCELS
	SECTION LINES
	AVIGATION EASEMENT
	RUNWAYS, TAXIWAYS, PARKING
	RUNWAY MARKINGS
	CENTERLINES
	RUNWAY PROTECTION ZONE
RSA	RUNWAY SAFETY AREA
OFA	OBJECT FREE AREA
OFZ	OBSTACLE FREE ZONE
	APPROACH SURFACE
TOFA	TAXIWAY OBJECT FREE AREA
BRL	BUILDING RESTRICTION LINE
RVZ	RUNWAY VISIBILITY ZONE

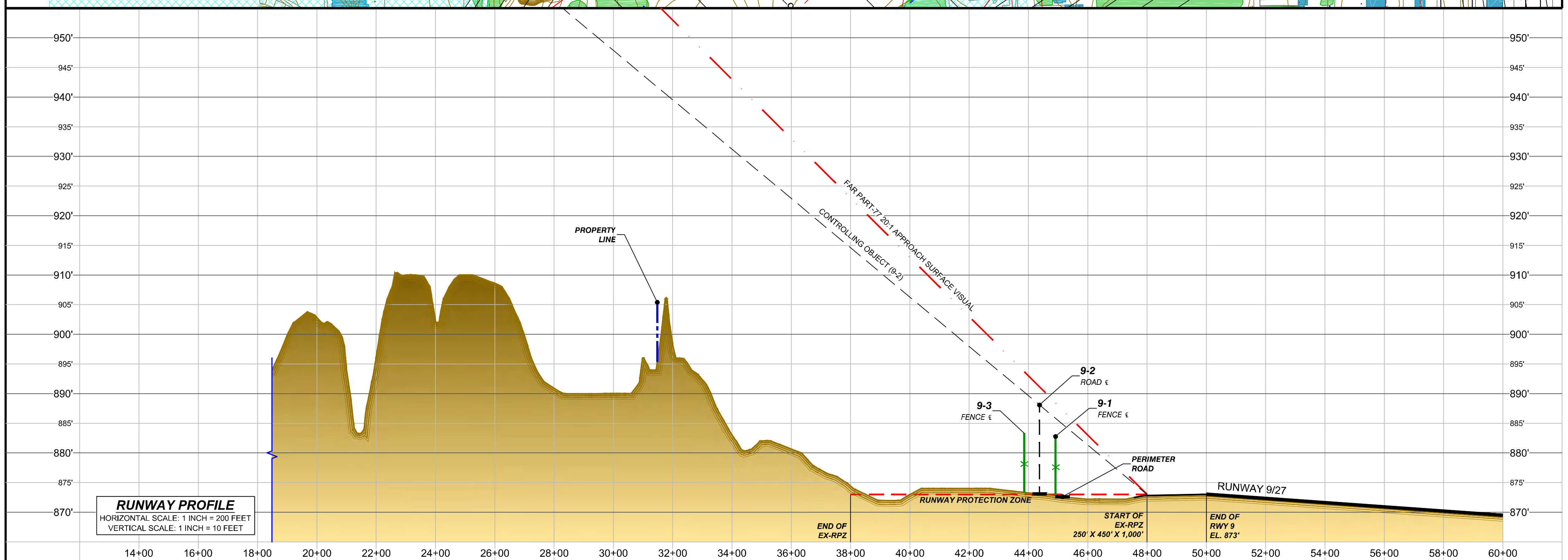
SCALE:

1 INCH = 200 FEET

0 100 200 400

MAGNETIC DECLINATION:

5° 19' W, 0° 4' W
PER YEAR AS OF 02/09/2011



RUNWAY PROFILE

HORIZONTAL SCALE: 1 INCH = 200 FEET
VERTICAL SCALE: 1 INCH = 10 FEET

OBSTRUCTION TABLE

NO.	DESCRIPTION	TOP EL.	ALLOWABLE EL.	PENETRATION	DISPOSITION	SURFACE IMPACTED
9-1	FENCE	883'	888'	-5'	REMAIN	RPZ, AS
9-2	ROAD(3)	888'	891'	-3'	REMAIN	RPZ, AS
9-3	FENCE	883'	894'	-11'	REMAIN	RPZ, AS

NOTES:
1. THE "TOP EL." AND "ALLOWABLE EL." ELEVATIONS ARE SHOWN AT "MEAN SEA LEVEL" (MSL).
2. THE "PENETRATION" ELEVATIONS ARE SHOWN AT "ABOVE GROUND LEVEL" (AGL).
3. THE TOP ELEVATION FOR "ROAD" INCLUDES THE FAR PART-77 15' CLEARANCE OVER ROADS REQUIREMENT.

GENERAL NOTES:

1. BASE DATA AND OBSTRUCTION SURVEY PROVIDED BY WOOLPERT, LLP. (JUNE 2010)
2. OBJECTS IN THE TRANSITIONAL SURFACE DESIGNATED BY THE SYMBOL "( )TS".
3. OBSTRUCTION MITIGATION IN THE TRANSITIONAL SURFACE NOT OWNED BY THE AIRPORT SHOULD BE CLEARED AS FUNDS BECOME AVAILABLE.
4. FINAL DISPOSITION OF TREES TO BE "MITIGATED" WILL BE DETERMINED AT TIME OF CONSTRUCTION. FINAL DISPOSITION (PRUNING OR REMOVAL) WILL BE BASED UPON ACTUAL HEIGHT OF TREES AND PREFERENCE OF OWNER.
5. ORDER OF IMPORTANCE FOR LOCATION OF THE OBSTRUCTION:
   1. RUNWAY AREA
   2. PRIMARY SURFACE (PS)
   3. OBJECT FREE AREA (OFA) / RUNWAY SAFETY AREA (RSA)
   4. RUNWAY PROTECTION ZONE (RPZ)
   5. APPROACH SLOPE (AS)
   6. TRANSITIONAL SURFACE (TS)

"OBSTRUCTION TABLE" LEGEND

NO.	OBJECT LABEL ON APPROACH SHEET
DESCRIPTION	TYPE OF OBJECT - (EX. ROAD, TREES, BUILDINGS)
TOP ELEVATION	HIGHEST POINT OF OBJECT
ALLOWABLE ELEVATION	ELEVATION ALLOWED BY THE RUNWAY SURFACE - (EX. RPZ, AS, TS)
PENETRATION	TOTAL AMOUNT OF OBJECT LOCATED WITHIN APPROACH SURFACE
DISPOSITION	THE DETERMINATION OF WHAT ACTION TO TAKE WITH REFERENCE TO THE OBJECT
SURFACE IMPACTED	THE OBJECTS LOCATION RELATIVE TO THE FAR PART-77 APPROACH SURFACES SURROUNDING THE RUNWAY

"DISPOSITION" LEGEND

REMAIN	THE OBJECT IS LOCATED WITHIN A RUNWAY SURFACE; HOWEVER, IT DOES NOT PENETRATE THE APPROACH SURFACE.
REMOVE	THE OBJECT IS CONSIDERED AN OBSTRUCTION AND SHOULD BE COMPLETELY REMOVED.
PRUNE	THE OBJECT IS A TREE WHICH NEEDS TO BE PRUNED IN ORDER TO MAINTAIN HEIGHT CLEARANCE DUE TO MINIMAL IMPACT INTO THE FAR PART-77 APPROACH SURFACE.

"SURFACE" LEGEND

RPZ	RUNWAY PROTECTION ZONE
AS	APPROACH SURFACE
TS	TRANSITIONAL SURFACE

REVISIONS

NO.	DATE	REMARKS	BY	CHK
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KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

AIRPORT LAYOUT PLAN

EXISTING RUNWAY 9 APPROACH PLAN

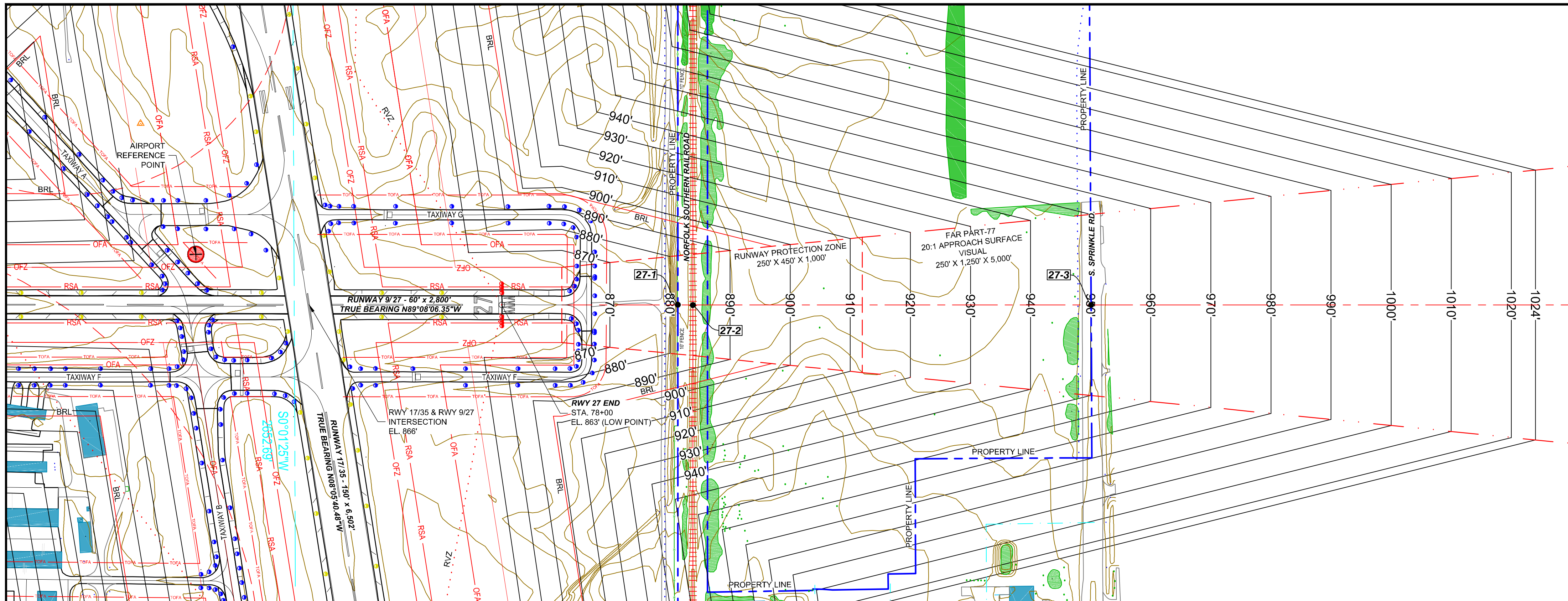
Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - 517.321.5932 FAX

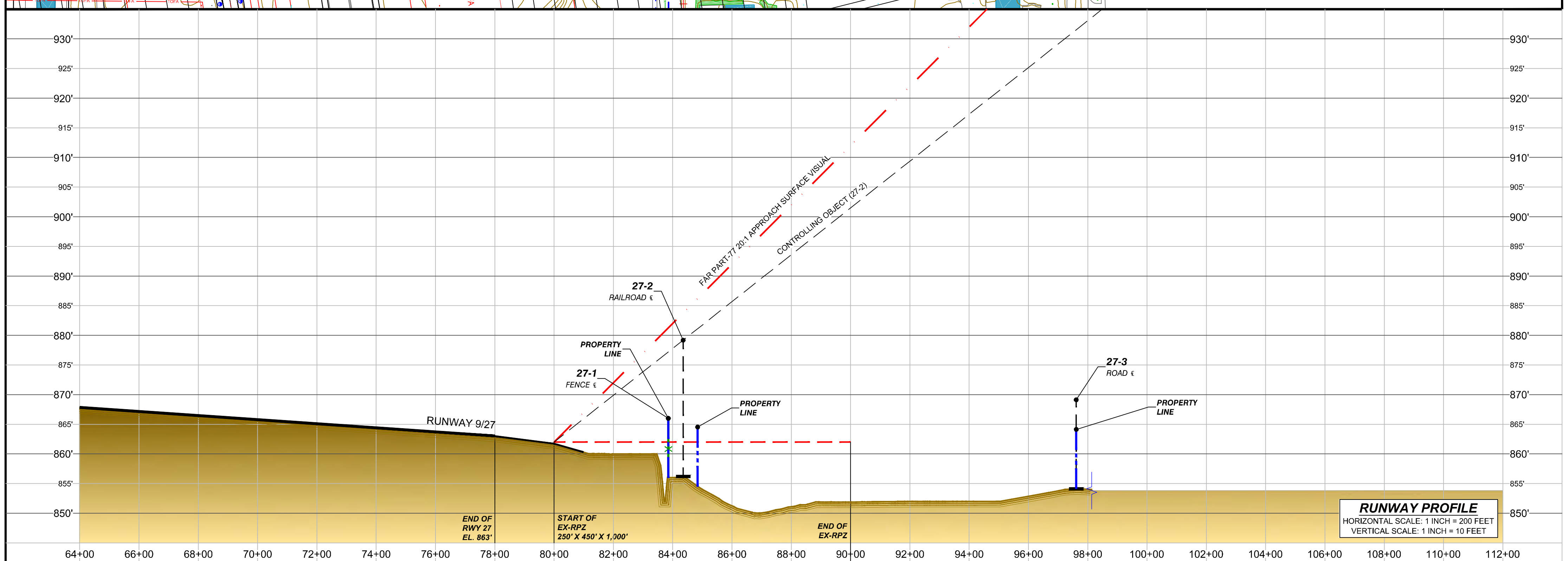
STATE ID. NO.			DESIGNED	SADW	06/01/11
39-02	M&H PROJECT NO.	11139-00-09004	DRAWN	AEF	06/01/11
	FEDERAL CONTRACT NO.	---	CHECKED	SADW	10/07/11
	STATE CONTRACT NO.	3-26-0052-3409			

SHEET: 17 OF 19

March 28, 2013 - 17 Ex-F Runway 9 Approach Plan.dwg

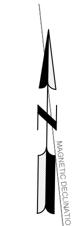
IF PAPER SIZE IS 24"x36" USE SCALE SHOWN. ALL OTHER PAPER SIZES ARE NOT TO SCALE.





LEGEND

FUTURE	EXISTING	ITEM
		BUILDINGS / TO BE REMOVED
		TREES AND TREE LINES
		FENCE LINES
		ROADS
		ROAD RIGHT-OF-WAY
		RAILROAD
		RIVERS, LAKES, COUNTY DRAINS
		GROUND CONTOURS
		WIND CONE
		ROTATING BEACON
		RUNWAY / TAXIWAY LIGHTING
		POWER POLE
		AIRPORT PROPERTY LINE
		PROPERTY PARCELS
		SECTION LINES
		RUNWAYS, TAXIWAYS, PARKING
		RUNWAY MARKINGS
		CENTERLINES
		RUNWAY PROTECTION ZONE
F-RSA	RSA	RUNWAY SAFETY AREA
F-OFA	OFA	OBJECT FREE AREA
F-OFZ	OFZ	OBSTACLE FREE ZONE
		APPROACH SURFACE
	TOFA	TAXIWAY OBJECT FREE AREA
F-BRL	BRL	BUILDING RESTRICTION LINE
F-RVZ	RVZ	RUNWAY VISIBILITY ZONE



SCALE:
1 INCH = 200 FEET
0 100 200 400

MAGNETIC DECLINATION:
5° 19' W, 0° 4' W
PER YEAR AS OF 02/09/2011

OBSTRUCTION TABLE

NO.	DESCRIPTION	TOP EL.	ALLOWABLE EL.	PENETRATION	DISPOSITION	SURFACE IMPACTED
27-1	FENCE	866'	881'	-15'	REMAIN	RPZ, AS
27-2	RAILROAD(4)	879'	884'	-5'	REMAIN	RPZ, AS
27-3	ROAD(3)	869'	950'	-81'	REMAIN	AS

NOTES:
1. THE "TOP EL." AND "ALLOWABLE EL." ELEVATIONS ARE SHOWN AT "MEAN SEA LEVEL" (MSL).
2. THE "PENETRATION" ELEVATIONS ARE SHOWN AT "ABOVE GROUND LEVEL" (AGL).
3. THE TOP ELEVATION FOR "ROAD" INCLUDES THE FAR PART-77 15' CLEARANCE OVER ROADS REQUIREMENT.
4. THE TOP ELEVATION FOR "RAILROAD" INCLUDES THE FAR PART-77 23' CLEARANCE OVER RAILROADS REQUIREMENT.

GENERAL NOTES:

1. BASE DATA AND OBSTRUCTION SURVEY PROVIDED BY WOOLPERT, LLP. (JUNE 2010)
2. OBJECTS IN THE TRANSITIONAL SURFACE DESIGNATED BY THE SYMBOL "( )TS".
3. OBSTRUCTION MITIGATION IN THE TRANSITIONAL SURFACE NOT OWNED BY THE AIRPORT SHOULD BE CLEARED AS FUNDS BECOME AVAILABLE.
4. FINAL DISPOSITION OF TREES TO BE "MITIGATED" WILL BE DETERMINED AT TIME OF CONSTRUCTION. FINAL DISPOSITION (PRUNING OR REMOVAL) WILL BE BASED UPON ACTUAL HEIGHT OF TREES AND PREFERENCE OF OWNER.
5. ORDER OF IMPORTANCE FOR LOCATION OF THE OBSTRUCTION:
   1. RUNWAY AREA
   2. PRIMARY SURFACE (PS)
   3. OBJECT FREE AREA (OFA) / RUNWAY SAFETY AREA (RSA)
   4. RUNWAY PROTECTION ZONE (RPZ)
   5. APPROACH SLOPE (AS)
   6. TRANSITIONAL SURFACE (TS)

"OBSTRUCTION TABLE" LEGEND

NO.	OBJECT LABEL ON APPROACH SHEET
DESCRIPTION	TYPE OF OBJECT - (EX. ROAD, TREES, BUILDINGS)
TOP ELEVATION	HIGHEST POINT OF OBJECT
ALLOWABLE ELEVATION	ELEVATION ALLOWED BY THE RUNWAY SURFACE - (EX. RPZ, AS, TS)
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"DISPOSITION" LEGEND

REMAIN	THE OBJECT IS LOCATED WITHIN A RUNWAY SURFACE; HOWEVER, IT DOES NOT PENETRATE THE APPROACH SURFACE.
REMOVE	THE OBJECT IS CONSIDERED AN OBSTRUCTION AND SHOULD BE COMPLETELY REMOVED.
PRUNE	THE OBJECT IS A TREE WHICH NEEDS TO BE PRUNED IN ORDER TO MAINTAIN HEIGHT CLEARANCE DUE TO MINIMAL IMPACT INTO THE FAR PART-77 APPROACH SURFACE.

"SURFACE" LEGEND

RPZ	RUNWAY PROTECTION ZONE
AS	APPROACH SURFACE
TS	TRANSITIONAL SURFACE

REVISIONS

NO.	DATE	REMARKS	BY	CHK
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KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

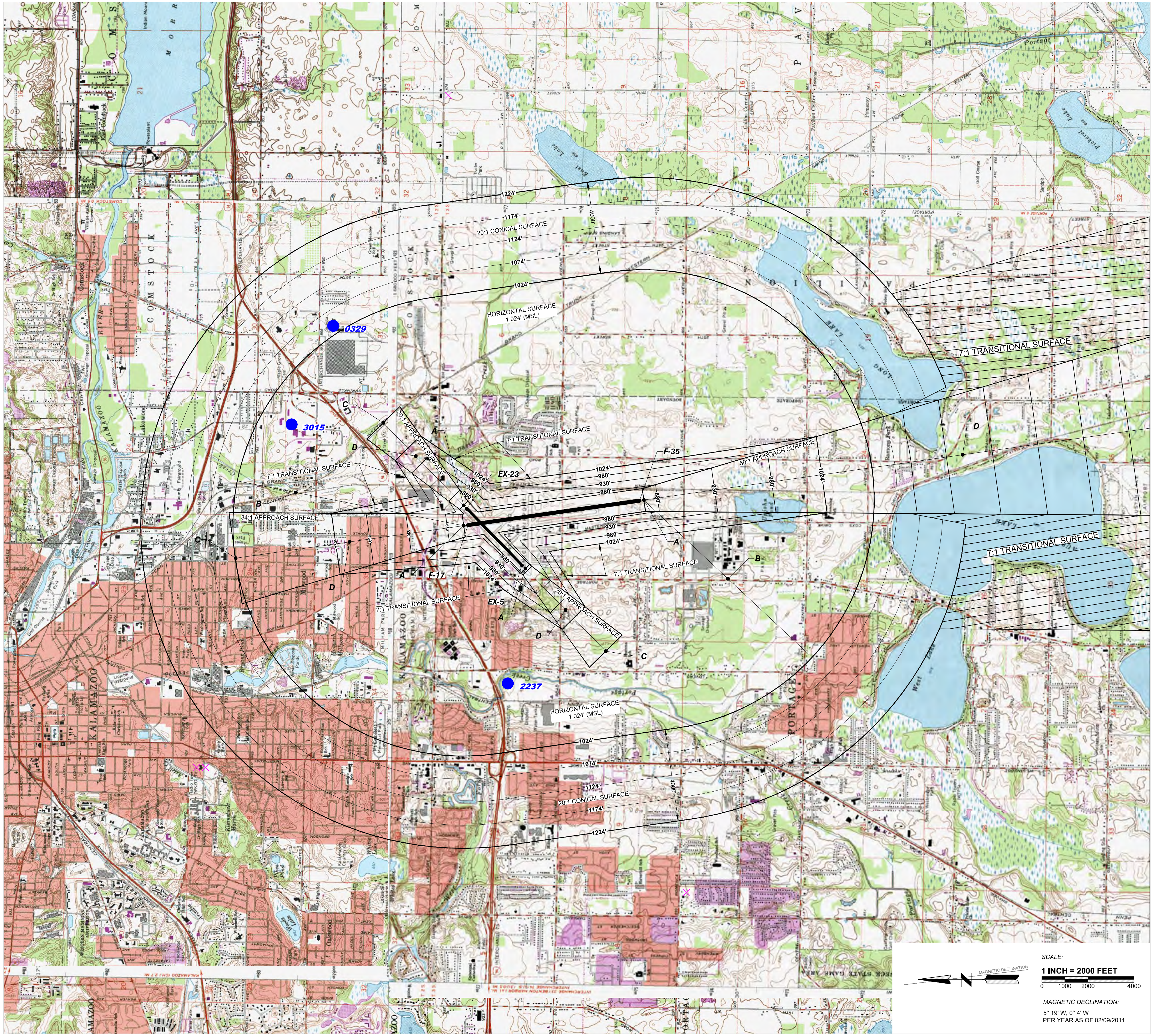
AIRPORT LAYOUT PLAN
EXISTING RUNWAY 27 APPROACH PLAN

Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - 517.321.5932 FAX

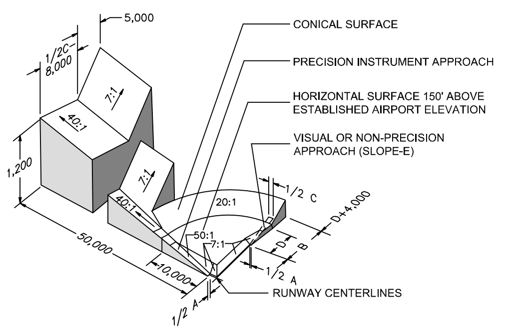
STATE ID. NO.				
39-02	M&H PROJECT NO. — 11139-00-09004	DESIGNED	SADW	06/01/11
	FEDERAL CONTRACT NO. — ---	DRAWN	AEF	06/01/11
	STATE CONTRACT NO. — 3-26-0052-3409	CHECKED	SADW	10/07/11

March 28, 2013 - 18 Ex-F Runway 27 Approach Plan.dwg

IF PAPER SIZE IS 24"x36" USE SCALE SHOWN. ALL OTHER PAPER SIZES ARE NOT TO SCALE.



ISOMETRIC VIEW OF SECTION A



RUNWAY END COORDINATES

ITEMS	FUTURE 17	FUTURE 35	EXISTING 5	EXISTING 23
LATITUDE (LAT.)	42° 14' 28.93"	42° 13' 15.72"	42° 14' 05.56"	42° 14' 29.61"
LONGITUDE (LONG.)	85° 33' 06.24"	85° 32' 50.81"	85° 33' 29.04"	85° 32' 56.77"

APPROACH SURFACE DIMENSIONS

	ITEMS	FUTURE 17	FUTURE 35	EXISTING 5	EXISTING 23
A	WIDTH OF PRIMARY SURFACE	1,000'	1,000'	500'	500'
B	RADIUS OF HORIZONTAL SURFACE	10,000'	10,000'	2,000'	2,000'
C	APPROACH SURFACE WIDTH AT END	4,000'	16,000'	5,000'	5,000'
D	APPROACH SURFACE LENGTH	10,000'	50,000'	2,000'	2,000'
E	APPROACH SURFACE RATIO	34:1	50:1	20:1	20:1

OBJECT DATA TABLE

OBJECT	TYPE	LATITUDE	LONGITUDE	STRUCTURE HEIGHT (AGL)	TOP ELEVATION (MSL)	ALLOWABLE ELEVATION (MSL)
0329	WATER TOWER	42° 15' 28.00"	85° 31' 12.00"	167'	1,027'	1,041'
2237	TOWER	42° 14' 11.00"	85° 34' 37.00"	180'	1,015'	1,015'
3015	TOWER	42° 15' 45.26"	85° 32' 09.26"	163'	1,019'	1,019'

GENERAL NOTES:

1. OBJECTS LOCATED WITH THE USE OF GIS DATA PROVIDED BY MDOT BUREAU OF AERONAUTICS. THE CURRENT GIS FILE CONTAINS ALL APPLICATIONS RECEIVED SINCE 1990.
2. MEAD & HUNT AND MDOT BUREAU OF AERONAUTICS ARE NOT RESPONSIBLE FOR THE ACCURACY OF THE NOAA DATABASE. THE DATABASE MAY NOT BE INCLUSIVE OF ALL OBSTACLES WITHIN THE PART 77 SURFACES SHOWN.
3. SECTIONAL CHARTS & THE FAA SHOULD BE REFERENCED FOR ADDITIONAL INFORMATION DUE TO THE CONTINUED PROLIFERATION OF TOWERS AND ASSOCIATED OBSTACLES.
4. SEE INNER PORTION OF THE APPROACH PLAN VIEW FOR CLOSE-IN OBSTRUCTIONS.

REVISIONS

NO.	DATE	REMARKS	BY	CHK
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KALAMAZOO-BATTLE CREEK INTERNATIONAL AIRPORT
KALAMAZOO, MICHIGAN

AIRPORT LAYOUT PLAN
FAR PART-77 PLAN

Mead & Hunt
2605 PORT LANSING ROAD
LANSING, MICHIGAN 48906
517.321.8334 - (FAX) 517.321.5932

STATE ID. NO.	M&H PROJECT NO. —	11139-00-09004	DESIGNED	SADW	06/01/11
39-02	FEDERAL CONTRACT NO. —	---	DRAWN	AEF	06/01/11
	STATE CONTRACT NO. —	3-26-0052-3409	CHECKED	SADW	10/07/11

IF PAPER SIZE IS 24"x36" USE SCALE SHOWN. ALL OTHER PAPER SIZES ARE NOT TO SCALE.

Prepared By:
Mead & Hunt, Inc.
2605 Port Lansing Road
Lansing, MI 48906